

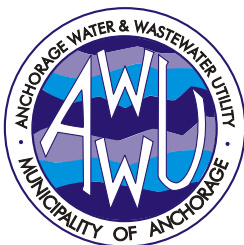
MONITORING PROGRAM ANNUAL REPORT

JANUARY - DECEMBER 2007

ANCHORAGE WATER AND WASTEWATER UTILITY JOHN M. ASPLUND WATER POLLUTION CONTROL FACILITY AT POINT WORONZOF



Prepared for:



MUNICIPALITY OF ANCHORAGE
Anchorage Water & Wastewater Utility
Anchorage, Alaska

Prepared by:



**KINNETIC
LABORATORIES
INCORPORATED**

1102 WEST 7th AVE., ANCHORAGE, AK 99501
(907) 276-6178

February 2008

MONITORING PROGRAM ANNUAL REPORT

JANUARY - DECEMBER 2007

ANCHORAGE WATER AND WASTEWATER UTILITY JOHN M. ASPLUND WATER POLLUTION CONTROL FACILITY AT POINT WORONZOF

NPDES Permit AK-002255-1

Prepared for:



Prepared by:



**KINNETIC
LABORATORIES
INCORPORATED**

1102 WEST 7TH AVE., ANCHORAGE, AK 99501
(907) 276-6178

February 2008

PREFACE

This document is the Monitoring Program Annual Report required for submittal to the Environmental Protection Agency by NPDES Permit AK-002255-1 for discharge from the John M. Asplund Water Pollution Control Facility, operated by the Municipality of Anchorage at Point Woronzof. The NPDES permit incorporates provisions necessitated by a 301(h) waiver from the requirements of secondary treatment.

The elements of the monitoring program are:

- Influent, Effluent, and Sludge Monitoring
 - In-Plant Sampling
 - Toxic Pollutant and Pesticide Sampling
 - Pretreatment Monitoring
 - Whole Effluent Toxicity Monitoring
- Receiving Water Quality Monitoring
 - Plume Dispersion
 - Intertidal Zone Bacteria
- Sediment and Bioaccumulation Monitoring
 - Sediment Analyses
 - Bioaccumulation Analyses

During 2007, the program consisted of sampling the influent, effluent, and sludge twice for toxic pollutants and pesticides and one receiving water quality sampling. In addition, the Municipality of Anchorage conducted the required self-monitoring program for the influent, effluent, and sludge. Sediment sampling was performed during 2003 and bioaccumulation sampling was performed during 2004. Bioaccumulation sampling had been scheduled for 2003 with the sediment analyses, but insufficient intertidal algae concentrations precluded the collection of samples in both 2003 and 2004. To fulfill the Permit objectives and requirements for a bioaccumulation program, it was proposed to EPA to perform a field bioaccumulation program utilizing a resident species from Upper Cook Inlet, the Pacific cod. This alternate study was approved by EPA and conducted in the fall of 2004.

This annual report provides information concerning the monitoring program performed to meet the requirements as set forth in the NPDES permit that became effective on 2 August 2000. The report covers the period of 1 January through 31 December 2007.

TABLE OF CONTENTS

PREFACE	i
TABLE OF CONTENTS	iii
LIST OF FIGURES	v
LIST OF TABLES	vi
APPENDICES (Bound Separately)	vii
SUMMARY	1
1.0 INTRODUCTION	5
1.1 REGULATORY/ENVIRONMENTAL BACKGROUND	5
1.1.1 Regulatory Background	5
1.1.2 Environmental Background	8
1.2 STUDY DESIGN	10
1.2.1 Monitoring Objectives	10
1.2.2 Program Description	10
1.2.3 Hypotheses	11
1.3 CONTRACTOR	11
1.4 PERIOD OF REPORT	11
2.0 METHODS	13
2.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING	13
2.1.1 In-Plant Monitoring	13
2.1.2 Toxic Pollutant and Pesticide Monitoring	13
2.1.3 Pretreatment Monitoring	15
2.1.4 Whole Effluent Toxicity Testing	15
2.1.5 Part 503 Sludge Monitoring	20
2.2 RECEIVING WATER QUALITY MONITORING	20
2.2.1 Water Quality Sampling	20
2.2.2 Intertidal Bacterial Sampling	21
2.2.3 Vessel Support	26
2.3 SEDIMENT AND BIOACCUMULATION MONITORING	27
2.4 LABORATORY ANALYSIS	27
2.5 DOCUMENTATION PROCEDURES	27
3.0 RESULTS	29
3.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING	29
3.1.1 Monthly Discharge Monitoring Data	29
3.1.2 Toxic Pollutants and Pesticides Analyses	31
3.1.3 Pretreatment Monitoring Data	39
3.1.4 Whole Effluent Toxicity Testing Results	41
3.1.5 Part 503 Sludge Monitoring Data	42
3.2 RECEIVING WATER QUALITY MONITORING RESULTS	43
3.2.1 Plume Dispersion Sampling	43
3.2.2 Intertidal Zone and Stream Bacterial Sampling	61
4.0 QUALITY ASSURANCE/QUALITY CONTROL	63
4.1 OBJECTIVES	63
4.2 FIELD QUALITY CONTROL	63
4.2.1 Documentation	64
4.2.2 Sample Handling	64
4.2.3 Navigation	64
4.2.4 Field Instrumentation	64

TABLE OF CONTENTS, CONTINUED

4.2.5	Sampling Variability.....	65
4.2.6	Field Check Samples.....	65
4.3	LABORATORY QUALITY CONTROL.....	65
4.3.1	Documentation.....	66
4.3.2	Calibration.....	66
4.3.3	Quality Control Procedures.....	66
4.3.4	Method Detection Limits.....	67
4.4	DATA REVIEW AND VALIDATION.....	68
4.5	QUALITY ASSURANCE/QUALITY CONTROL RESULTS.....	68
4.5.1	Field Instrumentation and Sampling Quality Control Results.....	68
4.5.2	Laboratory Quality Control Results.....	69
5.0	DISCUSSION.....	75
5.1	INFLUENT, EFFLUENT, AND SLUDGE MONITORING.....	75
5.1.1	Influent and Effluent Monitoring.....	75
5.1.2	Sludge Monitoring.....	90
5.2	WATER QUALITY MONITORING.....	90
5.2.1	Plume Dispersion Sampling.....	90
5.2.2	Fecal Coliform Bacteria.....	96
6.0	CONCLUSIONS.....	99
7.0	REFERENCES.....	101

LIST OF FIGURES

Figure 1.	General Study Area.....	6
Figure 2.	Asplund WPCF Outfall and Control Station Locations.....	9
Figure 3.	Asplund WPCF Outfall, ZID, and Locations of Intertidal Bacteriological Sampling	22
Figure 4.	Holey-Sock Drogue, Flotation, and Marker Buoy.....	23
Figure 5.	Tidal Information for Receiving Water Sampling, Ebb and Flood Tides.....	45
Figure 6.	Summary of Ebb Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 19 June 2007.....	47
Figure 7.	Summary of Flood Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 19 June 2007.....	48
Figure 8.	Tidal Information for Receiving Water Sampling, Control Tide	50
Figure 9.	Summary of Control Drogue Tracks and Receiving Water Sampling Locations at Point MacKenzie, 20 June 2007	51
Figure 10.	Sample Hydrographic Profiles from Outfall and Control Stations, June 2007.....	58

LIST OF TABLES

Table 1.	Overall Monitoring Requirements	12
Table 2.	Influent, Effluent, and Sludge Monitoring Requirements.	14
Table 3.	Methods for the Analysis of Toxic Pollutants and Pesticides for Influent, Effluent, and Sludge Monitoring	16
Table 4.	Preservation and Analytical Procedures for Influent, Effluent, and Sludge	17
Table 5.	Receiving Water Quality Monitoring Requirements	24
Table 6.	Methods, Preservation, and Maximum Holding Times for the Analysis of Receiving Water Quality Samples	25
Table 7.	Approximate Locations of Intertidal Bacteria Sampling Stations.	26
Table 8.	Discharge Monitoring Data for Influent and Effluent Non-Metals	30
Table 9.	Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 19 and 20 June 2007	32
Table 10.	Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 7 and 8 August 2007	35
Table 11.	Pretreatment Monitoring Data for Influent and Effluent Metals and Cyanide	40
Table 12.	Summary of WET Test Data from 2007	41
Table 13.	Part 503 Discharge Monitoring Data for Sludge Metals	44
Table 14.	2007 Drogue Tracking Information	46
Table 15.	Hydrographic and Water Quality Data, 19 and 20 June 2007	53
Table 16.	Concentrations of Dissolved Metals, Total Recoverable Metals, Cyanide, and Total Suspended Solids in Receiving Water and Effluent Samples	60
Table 17.	Supplemental Receiving Water and Effluent Hydrocarbon Analyses.	61
Table 18.	Summary of Bacterial Analyses, 19 June 2007	62
Table 19.	Sampling and Laboratory Variability for Water Quality Samples, 19 and 20 June 2007	70
Table 20.	Seabird SEACAT SBE-19 CTD Probe Variability Check, 20 June 2007	72
Table 21.	NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2007 Maximum Concentrations for Effluent Comparisons	76
Table 22.	Comparison Between Influent/Effluent Analysis Results for Anchorage and 40 POTWs	80
Table 23.	Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years	81
Table 24.	Historical Discharge Monitoring Data (1986 - Present) for Influent and Effluent Total Metals and Cyanide	85
Table 25.	Historical Discharge Monitoring Data (1986 - Present) for Influent and Effluent Non-Metals	88
Table 26.	Comparison Between Sludge Analysis Results for Anchorage and Typical and Worse Case Concentrations Used by EPA in Developing Median or Mean Environmental Profiles	91
Table 27.	Historical Discharge Monitoring Data (1986 - Present) for Metals in Sludge.	92
Table 28.	Significant Station Pairs at the 5 % Significance Level Using the Kruskal-Wallis and Dunn's Tests	93
Table 29.	State of Alaska Water Quality Standards for Receiving Water	95

APPENDICES (BOUND SEPARATELY)

APPENDIX A	Toxic Pollutant and Pesticide Monitoring, June Sampling
A1	Oil & Grease, Cyanide, and Metals TestAmerica Analytical Testing Corporation
A2	Priority Pollutants, Dioxin, Pesticides, and Hydrocarbons Severn Trent Laboratories, Inc.
A3	Asbestos Solar Environmental Services, Inc. and EMSL Analytical, Inc.
A4	Enterococci Spectra Laboratories
APPENDIX B	Toxic Pollutant and Pesticide Monitoring, August Sampling
B1	Oil & Grease, Cyanide, and Metals TestAmerica Analytical Testing Corporation
B2	Priority Pollutants, Dioxin, Pesticides, and Hydrocarbons Severn Trent Laboratories, Inc.
B3	Asbestos Solar Environmental Services, Inc. and EMSL Analytical, Inc.
B4	Enterococci Spectra Laboratories
APPENDIX C	Whole Effluent Toxicity Testing
C1	First Quarter Testing ToxScan, Inc.
C2	Second Quarter Testing ToxScan, Inc.
C3	Third Quarter Testing ToxScan, Inc.
C4	Fourth Quarter Testing ToxScan, Inc.

APPENDICES, CONTINUED (BOUND SEPARATELY)

APPENDIX D	Receiving Water Quality Monitoring
D1	Total Suspended Solids and Cyanide TestAmerica Analytical Testing Corporation
D2	Aromatic Hydrocarbons Severn Trent Laboratories, Inc.
D3	Polycyclic Aromatic Hydrocarbons Texas A&M GERG
D4	Trace Metals Battelle
D5	Intertidal Bacteria Spectra Laboratories
D6	Total Residual Chlorine Analytica Alaska, Inc.
D7	Color SGS Environmental Services, Inc.
D8	Turbidity and Salinity Kinnetic Laboratories, Inc.
D9	Hydrographic Data Profiles Kinnetic Laboratories, Inc.
D10	Field Data Sheets Kinnetic Laboratories, Inc.

SUMMARY

PURPOSE

This report is submitted in response to requirements of the U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC) as outlined in the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 that was signed on 30 June 2000 and became effective on 2 August 2000. This permit authorizes discharge of effluent from the John M. Asplund Water Pollution Control Facility (Asplund WPCF). Wastewater from the Municipality of Anchorage (MOA) is treated at this facility before discharge to the receiving waters of Knik Arm in Cook Inlet, Alaska. The NPDES permit incorporates the requirements necessitated by a 301(h) waiver from secondary treatment and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA, 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

HISTORY

In September 1979, the MOA submitted to the EPA a 301(h) secondary treatment waiver application proposing an improved discharge which eliminated chlorination and required the addition of both a 610-meter (m) extension and a 305-m diffuser to the Asplund WPCF outfall. The outfall extension was intended to move the point of discharge beyond the influence of a gyre that was reported to exist off Point Woronzof on a flood tide which was presumed to carry effluent toward shore, causing bacterial contamination of the shoreline.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. The central issue was to evaluate outfall design alternatives and the chlorination/no chlorination option in relation to a system of eddies that occur on the flood tide. These studies were completed and presented as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985). This amended plan recommended the use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same water quality standards could be met by chlorinating and installing an improved diffuser at the end of the existing outfall, there was no need to extend the outfall.

Concurrent with the studies to amend the facilities plan, a revised 301(h) waiver application was submitted to the EPA. After extensive EPA review, public comment, and hearings, the Final Permit Decision was issued and the five-year NPDES permit became effective 16 October 1985 (EPA, 1985a). As required by this permit, a multi-port diffuser was installed in August 1987 prior to the second year of receiving water sampling. Fourteen years of monitoring were performed under the initial NPDES permit.

The MOA submitted an application to renew the 301(h) waiver from secondary treatment in 1990. A more recent application was submitted in 1998 with additional information provided to EPA in 1999. A draft NPDES permit that incorporated the 301(h) waiver was issued in 1999 for public comment. The renewed permit was signed by EPA on 30 June 2000 to become effective on 2 August 2000 for five years. The permit was administratively extended in August 2005 pending a permit renewal decision from EPA. The most recent application for an NPDES permit and 301(h) waiver was submitted in January 2005 and is currently being reviewed by EPA.

RECEIVING WATER ENVIRONMENT

The Asplund WPCF discharges into Knik Arm, a unique body of estuarine water with extremely high tidal fluctuations (up to 11.6 meters [m] with a mean range of 7.89 m at Anchorage; NOAA/NOS, 1995). These fluctuations produce extensive tidal flats, swift tidal currents of 4 - 5 knots, and intense mixing within the Inlet. The water is almost a slurry because of the naturally high suspended sediment concentrations of up to 2500 milligrams/liter (mg/L). This sediment originates from glacial melt waters discharging into Cook Inlet.

Large temperature extremes occur between summer and winter. In the winter, ice can reach thicknesses of 1 - 2 m and consists of broken pieces due to the large tides and currents. Other important factors are the large volume of saline water present in Cook Inlet and mixing by tidal turbulence which allows this volume to be effective in wastewater dilution and assimilation.

MONITORING OBJECTIVES

The monitoring that was conducted during 2007 consisted of two main components: (1) in-plant monitoring of influent, effluent, and sludge, including whole effluent toxicity testing; and (2) receiving water quality monitoring in the vicinity of the discharge and at a control site across Knik Arm. Objectives of the 2007 program are summarized as follows:

2007 MONITORING OBJECTIVES

Influent, Effluent, and Sludge Monitoring

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- help monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the CWA
- provide data for evaluation of permit re-issuance

Water Quality

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- aid in assessing the water quality at the discharge point
- determine compliance with the regulatory criteria of Section 301(h) for the CWA
- determine the level of bacterial contamination in nearshore waters
- provide data for evaluation of permit re-issuance

MONITORING RESULTS

As part of its self-monitoring program, the Anchorage Water and Wastewater Utility (AWWU) conducted daily, weekly, and monthly sampling of influent, effluent, and sludge, depending on the parameter measured. In addition, monitoring for toxic pollutants and pesticides was conducted twice during 2007, once in June and once in August. Whole effluent toxicity testing was conducted quarterly, while receiving water quality monitoring was performed once in June. The following summarizes results of this year's monitoring based on the permit requirements:

2007 MONITORING RESULTS

Influent, Effluent, and Sludge

- Met permit objectives and requirements and State of Alaska water quality standards (AWQS) with the exception of fecal coliform. Results from parameters of particular concern are summarized below.
- MOA's self-monitoring of total residual chlorine (TRC) showed that the daily maximum for TRC in the effluent was met for the entire year.
- The maximum geometric mean of 850 fecal coliform by most probable number technique per 100 milliliters (FC MPN/100 mL) was not exceeded in 2007. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in May 2007.
- Total aromatic hydrocarbon, total aqueous hydrocarbon, and total ammonia concentrations in the effluent were below their maximum allowable effluent concentrations (MAECs).
- Cyanide and metals concentrations in the effluent never exceeded their MAECs at any time during any of the 2007 sampling events.
- MOA's self-monitoring of pH and TSS showed compliance with regulatory and permit effluent limitations. TSS and BOD₅ were well within the daily, weekly, and monthly criteria for the entire reporting period. Average monthly removals for BOD₅ and TSS of greater than 30 percent (%) are required by the amendment to the Clean Water Act (40 CFR Part 125; Final Rule, 8/9/94). The removal rate for both TSS and BOD₅ met the 30 % minimum removal requirement for all months during 2007. Annual removals were 75% for TSS and 35% for BOD₅ which indicate excellent plant performance.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were generally within the established range or lower than values from a national study of secondary treatment plants.
- Toxic pollutant sludge concentrations were found to be very low compared to the limits established under 40 CFR Part 503 and all were either not-detected or within the established range or lower than values from a national study of secondary treatment plants, with most metals falling at or below the typical concentrations and all metals well below 95th percentile worst case values.
- Whole effluent toxicity testing conducted quarterly met the permit limitations for chronic toxicity for all species and all sampling events in 2007.

Water Quality

- Little variation among stations was observed for most hydrographic parameters.

- To test the hypothesis that the water quality at the zone of initial dilution (ZID) boundary was not degraded with respect to the water quality at the nearfield and control stations, statistical comparisons were employed. Conventional parameters such as salinity, temperature, turbidity, color, and pH did show statistically significant differences between stations, however, these were not ascribed to the outfall but rather to the slightly different water mass properties across Knik Arm at the control site. No significant differences were seen for dissolved oxygen, TSS, fecal coliform, or TRC.
- Fecal coliform concentrations in offshore receiving water and intertidal samples were found to be very low at all stations. State-specified criteria of a median of 14 FC MPN/100 mL, a geometric mean of 20 FC MPN/100 mL, and of not more than 10 % of the samples exceeding 40 FC MPN/100 mL were met at all receiving water locations.
- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that dissolved metals were all below the State site-specific water quality standards. None of the dissolved metals exceeded the site-specific standards at the diffuser or control location. Significant differences between the outfall and control stations were seen for dissolved arsenic and mercury. Arsenic was found to be elevated at the outfall while mercury was higher at the control site, but water quality standards were still met. Total recoverable metals were elevated compared to the dissolved as a result of the high suspended sediment loads, however no significant differences were seen between the outfall and control locations.
- Although all cyanide concentrations in the receiving waters (outfall and control locations) were above the receiving water quality criterion limit of 1.0 µg/L, no statistically significant differences were detected between concentrations at the control and outfall stations with the highest levels seen at the control locations. The elevated cyanide levels seen in 2007 were attributed to seawater matrix interference experienced by the laboratory and are not associated with the Asplund WPCF discharge.
- Supplemental receiving water samples also demonstrated that total aromatic hydrocarbons and total aqueous hydrocarbons met the State's water quality standard at all locations. No statistically significant differences were detected between the control and outfall stations for either total aromatic hydrocarbons or total aqueous hydrocarbons.
- Turbidity met the State water quality criteria at all stations. TRC concentrations were at or below 0.010 mg/L (10 µg/L) at all stations, except three that were located within or near the ZID, as compared to the AWQS of 2.0 µg/L for salmonid fish and 10.0 µg/L for other marine organisms. As the lowest level detection limit that is achievable for TRC in seawater is higher than the State's most restrictive standard, it cannot be determined if this standard was met at all locations. Color was found to meet State water quality criteria of not exceeding natural conditions for all samples and locations.

CONCLUSIONS

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements with few exceptions and is showing no significant impacts to the marine environment.

1.0 INTRODUCTION

1.1 REGULATORY/ENVIRONMENTAL BACKGROUND

The monitoring program is designed to meet the requirements of the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 which authorizes discharge of municipal effluent into the Knik Arm of Cook Inlet receiving waters from the John M. Asplund Water Pollution Control Facility (Asplund WPCF), operated by the Municipality of Anchorage (MOA; Figure 1). The NPDES permit, which became effective on 2 August 2000, incorporates the requirements necessitated by a 301(h) secondary treatment waiver and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

1.1.1 Regulatory Background

In 1972, while the Asplund WPCF and outfall were being built for the MOA, the Federal Water Pollution Control Act (FWPCA) was amended to establish two phases of effluent limitations applicable to all Publicly Owned Treatment Works (POTWs). Under 301(b), POTWs were required to achieve secondary treatment of effluent by 1 July 1977 and the "best practicable waste treatment technology" by July 1983.

Congress again amended the FWPCA in 1977. Section 301(h) was added, providing that the Administrator of the EPA, upon application from a POTW and with the concurrence of the State, might issue an NPDES permit waiving the requirements of Section 301(b). On 15 June 1979, EPA promulgated the regulations regarding the issuance of this waiver of secondary treatment to an applicant discharging into certain ocean and estuarine waters and demonstrating compliance with the 301(h) criteria.

In September 1979, the MOA forwarded to the EPA a 301(h) waiver application proposing an improved discharge which eliminated chlorination and required the addition of both an extension and diffuser to the Asplund WPCF outfall. Earlier studies had recommended the construction of a 610-m outfall extension and a 305-m diffuser. The proposed extension/diffuser reportedly could meet fecal coliform receiving water standards without chlorination and prevent shore contact of the wastewater plume.

As a parallel program, the MOA undertook preparation of a wastewater master plan for the Anchorage area. The resultant Wastewater Facilities Plan for Anchorage, (Ott Water Engineers, Inc. et al., 1982) and the Environmental Impact Statement, City of Anchorage, Alaska, Wastewater Facilities (EPA and Jones & Stokes, 1982) were accepted by the EPA and ADEC.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. Significant efforts were included in this study to improve the reconnaissance level data upon which the outfall length and diffuser design were to be based and to evaluate bacterial standards applicable to Knik Arm. The central issue was to evaluate outfall design alternatives and the chlorination or no-chlorination option in relation to the presence of a system of eddies that occur to the east of Point Woronzof on the flood tide and that might be capable of transporting the effluent shoreward. These latter studies were completed and presented as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985).

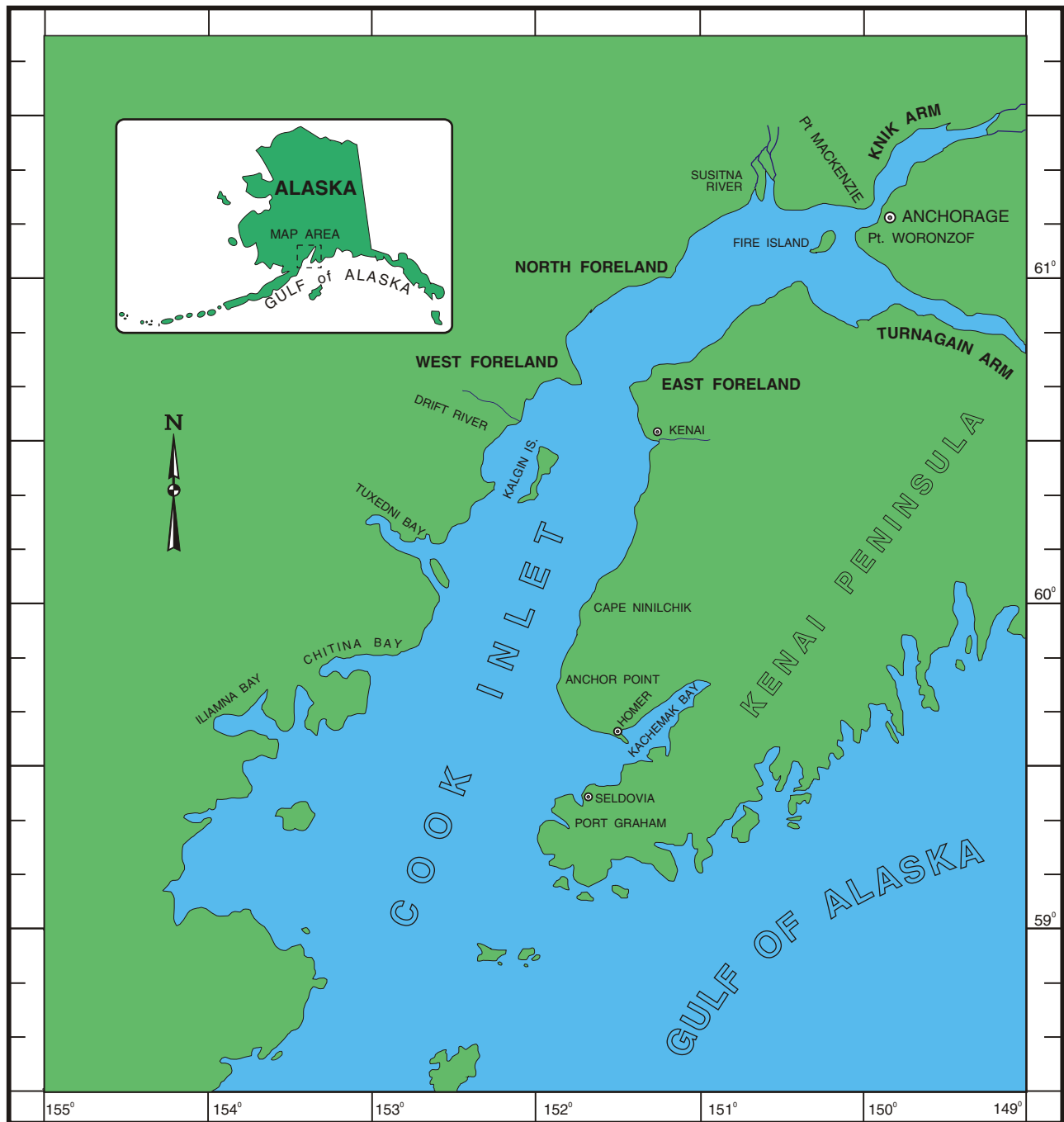


Figure 1. General Study Area.

This amended plan recommended use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same standards could be met by use of chlorination and the existing outfall, there was no need to extend the outfall. With continued chlorination, all water quality standards were predicted to be met by the amended plan.

Concurrent with the studies to amend the facilities plan, a revised application entitled Application for Modification of Secondary Treatment Requirements, Section 301(h), Clean Water Act was submitted to the EPA (CH2M Hill et al., 1984). The EPA Region 10 301(h) Review Team's Tentative Decision Document, entitled Analysis of the Section 301(h), Secondary Treatment Variance Application for the Asplund WPCF (EPA, 1985b), and a draft NPDES permit were made available for public comment on 17 January 1985. After comments and appropriate hearings, the Final Permit Decision (EPA, 1985a) was issued 13 September 1985, and the start date of the five-year NPDES Permit AK-002255-1 was listed as 16 October 1985. As required by this permit, a multi-port diffuser was installed at the Asplund WPCF outfall in the beginning of August 1987. This occurred prior to the 1987 summer water quality monitoring program. This original NPDES permit expired on 15 October 1990.

The MOA submitted a renewal application for the permit in April 1990 which addressed amendments made to the 301(h) provisions by the Water Quality Act. That renewal application was not acted upon and the facility continued to operate under an administrative extension of the 1985 permit until August 2000. In 1998 it was projected that the growth of Anchorage would result in the discharge limits contained in the 1985 permit being exceeded within a few years. Therefore, the MOA prepared and submitted another renewal application which replaced the 1990 application in October 1998 (CH2M Hill, 1998).

In tandem with the renewal application, the MOA conducted special studies and submitted a request for site-specific water quality criteria (SSWQC) to the ADEC for the Point Woronzof area of Cook Inlet in December 1998. This request for SSWQC was for turbidity and a suite of metals and was necessitated because the Alaska Water Quality Standards (AWQS) for marine waters could not be achieved for these waters as a result of the naturally high suspended sediment loads in Cook Inlet due to glacial inputs. The approach to the request was based on the EPA's Metals Policy that had been recently promulgated which recommends the use of only the dissolved fraction of metals as bioavailable and appropriate for the protection of aquatic life and associated beneficial uses of the water body. Following both agency and public review and comments, the SSWQC were incorporated into the AWQS as amended on 27 May 1999. The SSWQC for the Point Woronzof area included turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc.

Following the promulgation of these new AWQS, a tentative decision to grant the MOA its 301(h) variance was made by EPA on 4 November 1999. The tentative decision, draft NPDES permit, and fact sheet were then made available for public review and comments. The State of Alaska's Division of Government Coordination issued its Final Consistency Determination for the action in February 2000. The current NPDES permit for the Asplund WPCF was signed by EPA and went into effect 2 August 2000 for five years, and was administratively extended in August 2005 pending permit renewal. The most recent application for an NPDES permit and 301(h) waiver was submitted in January 2005 and is currently under review by EPA. The NPDES permit specified the required monitoring program. The Monitoring Program Plan (Kinnetic Laboratories, Inc., 2000a), submitted to the EPA in October 2000, identified how the

MOA plans to fulfill the requirements of this program. This report documents the progress and results of the monitoring program performed in 2007 under the current NPDES permit.

Since the issuance of the current Permit, EPA has approved ADEC's proposed use of dissolved metals for the State's marine water quality criteria, approved all of the proposed SSWQC for Upper Cook Inlet in the vicinity of Pt. Woronzof, and removed Alaska from the National Toxic Rule (EPA, 2006). Except for cadmium where the dissolved standard changed from 9.3 µg/L to 8.8 µg/L, all other dissolved metals criteria are the same as those listed in the SSWQC.

1.1.2 Environmental Background

The Asplund WPCF discharges to the receiving waters of Cook Inlet, Alaska. The discharge is located off Point Woronzof in Knik Arm of Upper Cook Inlet.

Cook Inlet is a major tidal estuary that is approximately 333 kilometers (km; 180 nautical miles) long and 93 - 148 km (50 - 80 nautical miles) wide at its lower end. Bathymetry indicates the Inlet is deep, generally 36.6 m (20 fathoms) north of the Forelands and about 164.6 m (90 fathoms) at the mouth. Numerous rivers, including the major Susitna River drainage, discharge into the Inlet. A detailed map of the Point Woronzof region indicates deep water (9.1 - 51.8 m) extending well past Anchorage up the Knik Arm (Figure 2).

Cook Inlet is a unique estuary, with perhaps the closest parallel being the Bay of Fundy between New Brunswick and Nova Scotia, Canada. The occurrence of tidal bores at the head, currents of 4 - 5 knots, suspended loads of up to 2500 mg/L, large temperature extremes, and moving pancake ice of up to one meter (m) thick make Cook Inlet unique. The high tidal ranges result from the geometry of the Inlet which has a natural resonance period close to the semi-diurnal tidal period. The resulting large tidal currents cause complete vertical mixing of the Inlet waters.

In addition to these features, two other factors are important to this study. They are the very large volume of saline water present in the Inlet and the degree of mixing achieved by the tidal turbulence which allows these volumes to be effective in wastewater dilution and assimilation.

The particle size distributions of the natural suspended sediments off Point Woronzof show that very large particles are suspended by the current-generated turbulence, with 50 percent (%) of the load being in the size range of 65 - 250 microns. The settling of large particles is seen in the Inlet at slack tide. Settling rate tests of the suspended material show that 93 % of the solids in the ambient water sample settle in twenty minutes.

Previous work has indicated that due to the extremely swift currents, no seabed accumulation of suspended sediments, either natural or from the discharge, occur in the vicinity of the outfall. In this location, the bottom is strictly coarse gravel and cobble because of these currents. However, areas of deposition do exist, such as to the east of Point Woronzof, where mudflats and beaches are found, and to the southwest of the Point. The area between Fire Island and the mainland is hard-packed sand with no deposition of silt or finer materials as a result of the high current energy. Silt sedimentation is a difficult problem at the Port of Anchorage where the Corps of Engineers conduct annual dredging operations. Of course, any suspended solids in these materials of effluent origin would be diluted by the much larger natural load in the receiving water (400 - 2,500 mg/L versus approximately 50 mg/L effluent).

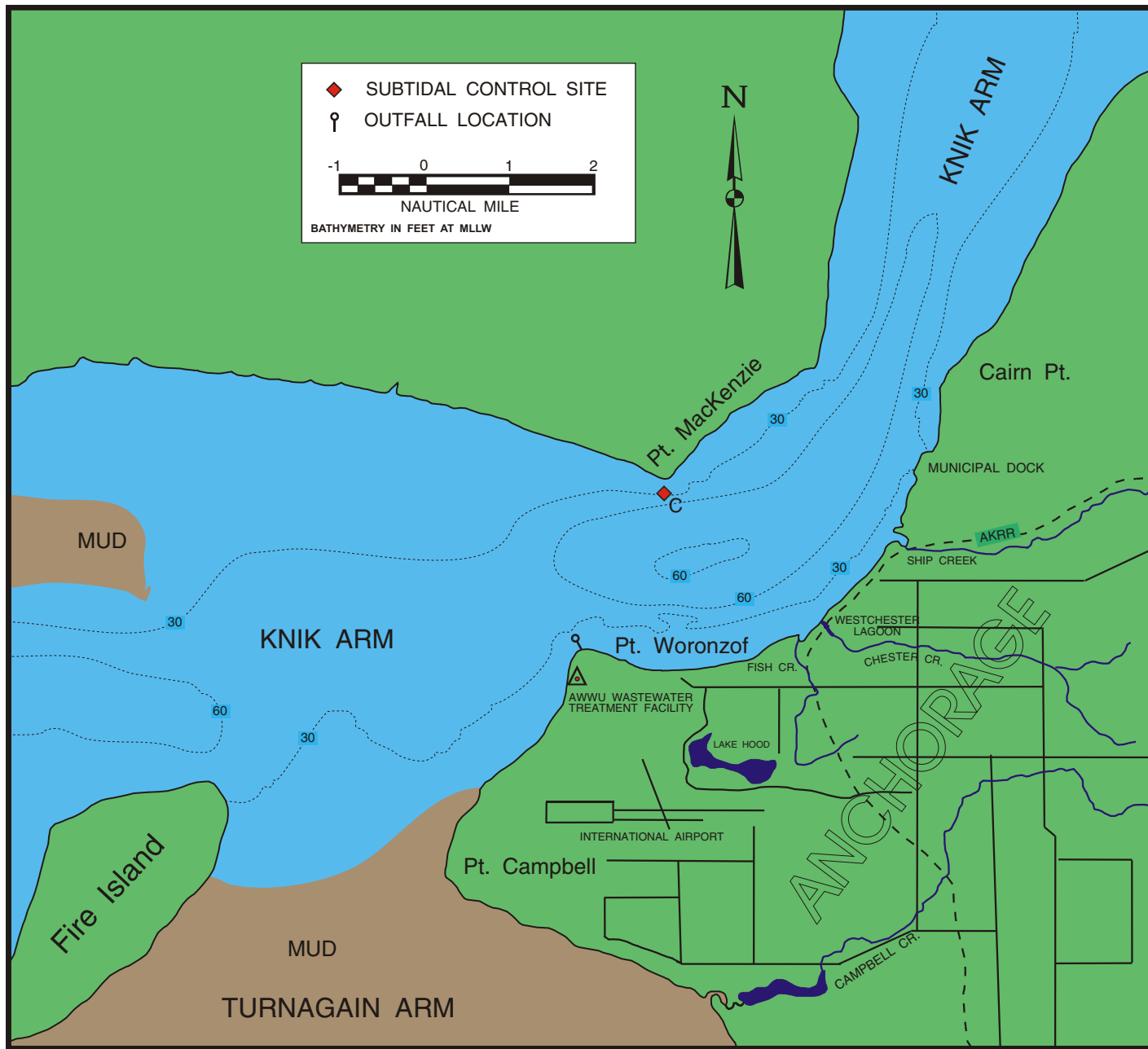


Figure 2. Asplund WPCF Outfall and Control Station Locations.

Studies have also shown that essentially no benthic biota are found on the scoured cobble/gravel bottom or on the rock beaches at Point Woronzof and the control area. Similar sampling of soft bottom beaches and tidal flats showed very sparse abundances and very low diversities. The harsh physical environment of silt, turbulence, currents, tides, and ice, limit benthic and intertidal marine fauna populations.

Current trajectories in the immediate vicinity of the outfall are of concern because of flow separation zones on either side of Point Woronzof. Previous work has indicated that, on a flood tide, a clockwise system of eddies exist east of Point Woronzof. These eddies may result in the shoreward transport of wastes at certain stages of tide. A flow separation also exists to the west of Point Woronzof during ebb flow; however the effluent is not entrained shoreward in this area.

1.2 STUDY DESIGN

1.2.1 Monitoring Objectives

The monitoring program as described by NPDES Permit No. AK-002255-1 includes plant influent/effluent sampling; sewage sludge management procedures; water quality monitoring; biological and toxicological monitoring; and a toxics control program. The objectives of the overall monitoring program are to:

- determine compliance with the NPDES permit
- determine compliance with State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the Clean Water Act (CWA)
- determine the level of bacterial concentrations in nearshore waters
- monitor for changes in sediment quality (organic enrichment, alteration of grain size distribution, and pollutant contamination)
- determine if pollutants from the discharge are accumulating in exposed biological organisms
- provide data for evaluation of permit re-issuance

1.2.2 Program Description

The elements of the monitoring program for the Asplund WPCF are:

- Influent, Effluent, and Sludge Monitoring, including
 - In-Plant Sampling
 - Toxic Pollutants and Pesticides (including Metals and Cyanide)
 - Pretreatment Monitoring
 - Whole Effluent Toxicity (WET) Testing
- Receiving Water Quality Monitoring, including
 - Plume Dispersion
 - Intertidal Bacteria

- Biological and Sediment Monitoring, including
 - Sediment Quality
 - Bioaccumulation

Table 1 provides an overview of the monitoring requirements as described by the permit. Detailed information regarding each program component is provided in Section 2.0, Methods.

1.2.3 Hypotheses

The null (no effect) hypotheses tested for this year of monitoring as follows:

H_{o1}: Applicable State and Federal effluent and receiving water standards were met by the Asplund WPCF discharge.

H_{o2}: Water quality at the boundary of the ZID was not significantly changed with respect to nearfield or control stations.

1.3 CONTRACTOR

The MOA's designated contractor for the 2007 Asplund WPCF Monitoring Program was Kinnetic Laboratories, Inc. (KLI) of Anchorage, Alaska.

For influent, effluent, and sludge monitoring, aromatic hydrocarbon, pesticide, and volatile and semi-volatile priority pollutant analyses (gas chromatography/mass spectrometry scans) were performed by Severn Trent Laboratories, Inc. of Sacramento, California and Denver, Colorado. Trace metals (total and dissolved) for the toxic pollutant and pesticide and pretreatment monitoring, normally performed by the Municipality's Asplund WPCF Laboratory was performed by TestAmerica Analytical Testing Corporation (TestAmerica) of Seattle, Washington. WET testing was performed by ToxScan, Inc. of Watsonville, California. Asbestos analyses were performed by Solar Environmental Services, Inc. of Anchorage, Alaska, and EMSL Analytical of Westmont, New Jersey.

In addition, the Municipality's Asplund WPCF Laboratory performed monthly in-plant analyses as part of its self-monitoring program and conducted Part 503 sludge monitoring.

Analytica Alaska Inc. of Anchorage, under subcontract to KLI, provided analytical and field support for the receiving water sampling for total residual chlorine (TRC). Analytical support for the receiving water sampling included: Battelle (Sequim, Washington) for trace metals; SGS Environmental Services, Inc. (Anchorage, Alaska) for color, TestAmerica (Seattle, Washington) for total suspended solids (TSS), and cyanide; Severn Trent Laboratories, Inc. (Denver, Colorado) for aromatic hydrocarbons; Spectra Laboratories in (Tacoma, Washington) for bacteriology, and Texas A&M University's Geochemical and Environmental Research Group (GERG) (Texas) for polycyclic aromatic hydrocarbons (PAHs) analyses.

1.4 PERIOD OF REPORT

This report documents the progress and results of the monitoring program from 1 January through 31 December 2007 under the current NPDES permit.

Table 1. Overall Monitoring Requirements.

Parameter	Frequency	Sample Type	Remarks
In-Plant Sampling	See Table 2	See Table 2	See Table 2 - includes flow, TRC, DO, BOD ₅ , TSS, temperature, pH, fecal coliform, total ammonia as nitrogen, enterococci bacteria, and oil and grease
Toxic Pollutants and Pesticides (including Metals and Cyanide)	2/year ^a	influent, 24-hr composite effluent, 24-hr composite sludge, 24-hr composite	See Table 2
Pretreatment Program	2/year ^{a,b}	influent, three 24-hr composite effluent, three 24-hr composite sludge, 24-hr composite (8 grabs/day)	Includes metals and cyanide plus percent solids for sludge
Whole Effluent Toxicity (WET) Testing	4/year ^c	effluent, 24-hr composite	See Table 2
Receiving Water Quality	1/year ^d	receiving water	See Table 5
Intertidal Bacteria	1/year ^e	intertidal receiving water	Fecal coliform sampling at 8 intertidal stations
Sediment	Once during the fourth year of the permit ^e	grab samples of surficial (0-2 cm) sediment collected at intertidal and subtidal stations ^f	Includes total volatile solids (TVS), toxic pollutants and pesticides (including metals and cyanide), and sediment grain size distribution
Bioaccumulation	Once during the fourth year of the permit	grab samples of intertidal macroalgae (<i>Vaucheria</i> spp.) Note: Macroalgae was not available during 2003 or 2004. Therefore, in consultation with EPA and AWWU pacific cod (<i>Gadus macrocephalus</i>) were collected and analyzed for this permit component in October 2004 ^g	Includes toxic pollutants and pesticides (including metals and cyanide)

^a Sampling will be conducted twice per year: once in summer dry conditions and once in summer wet conditions.

^b The first day of three consecutive days of sampling will be part of the Toxic Pollutant and Pesticides (metals and cyanide) sampling performed twice each year.

^c WET testing will be performed on a quarterly basis.

^d Sampling will be conducted once per year in summer dry conditions.

^e Sampling will be conducted in conjunction with the receiving water sampling.

^f Sampling will be performed at Intertidal Stations 1, 2, and Control (IT-1, IT-2, and IT-C); a subtidal station located at the ZID boundary, and a subtidal control station near Point MacKenzie (in a similar water depth as the ZID boundary).

^g Sampling was to be performed in conjunction with the sediment analyses however algae was not available in sufficient quantities for sampling in 2003 or 2004. Pacific cod were collected and analyzed for this permit component in October 2004.

2.0 METHODS

2.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING

Influent, effluent, and sludge monitoring is outlined in Table 2. Routine daily, weekly, and monthly sampling of conventional pollutant parameters and flow rate were performed by AWWU. The less-frequently monitored parameters of enterococci bacteria, oil and grease, toxic pollutants and pesticides (including metals and cyanide), and Whole Effluent Toxicity (WET) testing were handled by AWWU and KLI.

- ✓ determine compliance with the NPDES permit and State of Alaska water quality criteria
- ✓ determine effectiveness of the industrial pretreatment program
- ✓ aid in assessing the water quality at the discharge point
- ✓ characterize toxic substances
- ✓ help monitor plant performance
- ✓ determine compliance with the regulatory criteria of Section 301(h) of the CWA
- ✓ provide data for evaluating re-issuance of this permit

2.1.1 In-Plant Monitoring

In-plant influent, effluent, and sludge sampling was performed by AWWU personnel as described in Table 2 and in a separate study plan provided by AWWU (AWWU, 2000). Samples were obtained following the schedule of frequency required by the permit. Influent was sampled at a representative location in the influent headworks, upstream from the recycle streams. Effluent was sampled at a well-mixed point downstream from the chlorination input (the final effluent line). Composite sludge samples were obtained from the belt filter press. Grab samples were obtained for total residual chlorine (TRC), dissolved oxygen (DO), temperature, pH, and fecal coliform. Composite samples were obtained for analysis of biochemical oxygen demand (BOD₅), total suspended solids (TSS), and total ammonia as nitrogen.

2.1.2 Toxic Pollutant and Pesticide Monitoring

As outlined in the permit, toxic pollutant and pesticide sampling was conducted twice this year, once during June 2007 (summer dry) and once during August 2007 (summer wet). Samples were collected as required by the permit and either analyzed by AWWU personnel or provided to KLI for shipment to the appropriate analytical laboratory. Plant influent was sampled as discrete grabs or by flow-proportional composite samplers (depending on the analysis method) at a representative location in the influent headworks upstream from the recycle streams. Effluent was sampled as discrete grabs or flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Influent and effluent samples were chilled as required during composite sampling. Composite sludge samples were obtained from the belt filter press.

Samples were composited for the analysis of pesticides, semi-volatile organics, metals, asbestos, and cyanide. Samples consisted of composites of flow-proportioned samples collected over a 24-hour (hr) period using two ISCO Model 3700 Refrigerated Autosamplers. Grab samples for volatile organics analysis were collected every three hours during the 24-hr sampling period and designated for compositing during analysis at the laboratory. Grab samples were collected for

Table 2. Influent, Effluent, and Sludge Monitoring Requirements.

Parameter	Sample Point ^a	Sample Frequency	Sample Type
Flow ^b	effluent	continuous	continuous
Total Residual Chlorine (TRC) ^b	effluent	continuous <u>or</u> every 2-4 hrs	grab
Dissolved Oxygen (DO) ^b	effluent	4/week	grab
Biochemical Oxygen Demand (BOD ₅) ^b	influent and effluent	4/week	24-hr composite
Total Suspended Solids (TSS) ^b	influent and effluent	4/week	24-hr composite
Temperature ^b	influent and effluent	4/week	grab
pH ^b	influent and effluent	4/week	grab
Fecal Coliform Bacteria ^b	effluent	3/week	grab
Total Ammonia as N ^b	effluent	1/month	24-hr composite
Enterococci Bacteria ^c	effluent	2/year ^d	grab
Oil and Grease ^b	effluent	2/year ^d	grab
Toxic Pollutants and Pesticides (including Metals and Cyanide) ^e	influent, effluent, and sludge	2/year ^d	24-hr composite
WET ^f	effluent	4/year ^f	24-hr composite

^a When both influent and effluent samples are required, samples will be collected during the same 24-hr period.

^b AWWU will perform this monitoring component.

^c KLI will perform this monitoring component.

^d Twice per year sampling: once during summer in dry conditions and once in wet conditions.

^e As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, molybdenum, nickel, silver, and zinc in influent, effluent, and sludge will be sampled, along with percent solids (in sludge only). In 2007, these metals were analyzed and reported by TestAmerica Analytical Testing Corporation as total recoverable metals and dissolved metals for influent and effluent and as total metals in mg/kg dry weight for sludge. Sampling will be as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Mon - Fri), the first day of which coincides with the twice yearly sampling (summer-dry and-wet conditions); sludge as one composite of eight grabs/day when influent and effluent samples are being taken. In addition, the other four metals from the toxic pollutant list will be analyzed in the summer wet/summer dry samples: beryllium, antimony, thallium, and selenium (by TestAmerica Analytical Testing Corporation).

^f WET requirements are summarized in the text (Section 2.1.4). Initial testing will be a screening period performed during three quarters, during which three species will be tested to determine the most sensitive species. Re-screening will be performed each year during one quarter (different than the previous year) to determine the species to use for continued testing. Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units, TUC=100/NOEC).

analysis of total hydrocarbons as oil and grease and purgeable aromatic compounds. Sludge samples were collected from the conveyor belt every three hours over a 24-hr period and the eight samples composited.

At time of collection, all samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.5. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

Toxic pollutants as defined by the permit are those substances listed in 40 Code of Federal Regulations (CFR) 401.15 (Table 3). This list involves 65 categories of pollutants, including asbestos, aromatic hydrocarbons, pesticides, metals, and polychlorinated biphenyls (PCBs). Pesticides as defined in the permit are demeton, guthion, malathion, mirex, methoxychlor, and parathion as listed in 40 CFR 125.58. Other pesticides which were tested are included on the toxic pollutants list (40 CFR 401.15). The methods that were used to analyze these constituents for this program and for which KLI will be responsible, as well as those performed by AWWU, are also provided in Table 3. Preservation and maximum holding time information for each of these methods is provided in Table 4. All samples were collected in the appropriate precleaned sample containers and preserved, if necessary, as described by the EPA method. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

2.1.3 Pretreatment Monitoring

The pretreatment program as outlined in Table 1 and Table 2 was performed by the AWWU. This monitoring was performed twice in 2007 in conjunction with the summer dry and wet sampling. As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc in influent, effluent, and sludge were sampled, along with percent solids (in sludge only). These metals are normally analyzed and reported by AWWU, however due to Plant construction activities in 2007, they were analyzed by TestAmerica as total recoverable metals and dissolved metals for influent and effluent and as total recoverable metals in dry weight for sludge. Sampling was conducted as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Monday - Friday), the first of which coincided with the twice-yearly sampling (summer dry and summer wet, respectively); sludge as one composite of eight grabs/day when influent and effluent samples were being taken. A detailed study plan describing this monitoring was provided previously (AWWU, 2000).

2.1.4 Whole Effluent Toxicity Testing

As outlined in the permit, the WET testing must be performed on a quarterly basis on 24-hr composite effluent samples. Effluent was sampled by discrete flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Effluent samples were collected in the appropriate precleaned sample containers as described by the method, chilled, and shipped immediately to the toxicity laboratory for testing. Samples were appropriately labeled at the time of collection using pre-prepared, project-specific sample labels as described in Section 2.5. Sample collection and shipment were documented using project-specific chain of custody forms. Sample containers were immediately placed on gel ice after sampling and remained chilled during shipment to the analytical laboratory.

Table 3. Methods^a for the Analysis of Toxic Pollutants and Pesticides for Influent, Effluent, and Sludge Monitoring.

Volatile Organic Compounds	Semi-Volatile Organic Compounds	Pesticides and PCBs	Inorganic Compounds
EPA 624 (Inf/Eff) SW 8260B (Sludge) Benzene Chlorinated benzenes Dichlorobenzenes Ethylbenzene Toluene Xylenes ^b	EPA 625 (Inf/Eff) SW 8270C (Sludge) Acenaphthene Benzidine ^c Chloralkyl ethers Chlorinated ethanes Chlorinated naphthalenes Chlorinated phenols 2-chlorophenol DDT & metabolites Dichlorobenzenes Dichlorobenzidine 2,4-dichlorophenol 2,4-dimethylphenol Dinitrotoluene Diphenylhydrazine Fluoranthene Haloethers Heptachlor & metabolites Hexachlorobutadiene Hexachlorocyclopentadiene ^c Hexachloroethane Isophorone Naphthalene Nitrobenzene Nitrophenols Nitrosamines Polycyclic aromatic hydrocarbons (PAHs) Pentachlorophenol Phenol Phthalate esters	EPA 614 (Inf/Eff) SW 8141A (Sludge) Demeton Malathion Parathion Guthion ^b	EPA 100.1/EPA 100.2 (Inf/Eff) Polarized Light Microscopy (PLM; Sludge) Asbestos
EPA 624 (Inf/Eff) SW 8260B (Sludge) Acrolein ^b Acrylonitrile ^b Benzene Carbon tetrachloride Chloralkyl ethers Chloroform Chlorinated benzenes Chlorinated ethanes 1,2-dichloroethane Dichloroethylenes Dichloropropane Dichloropropene 1,1,1-trichloroethane Ethylbenzene Halomethanes Methylene chloride Bromoform Dichlorobromomethane Toluene Tetrachloroethylene Trichloroethylene Vinyl chloride	EPA 608 (Inf/Eff) SW 8081A Pesticides and SW 8082 PCBs (Sludge) Aldrin/Dieldrin Chlordane (technical Mixture & metabolites) DDT & metabolites Endosulfan & metabolites Endrin & metabolites Heptachlor metabolites Hexachlorocyclohexane Polychlorinated biphenyls (PCBs) Toxaphene Mirex ^b Methoxychlor ^b	EPA 200.8 (Inf/Eff) SW 6020 (Sludge) Antimony Arsenic Beryllium Cadmium Chromium Copper Lead Molybdenum Nickel Silver Selenium Thallium Zinc EPA 245.1 (Inf/Eff) SW7471A (Sludge) Mercury SM 4500 (Inf/Eff) EPA 9010B Mod (Sludge) Cyanide	
	SW 8280A (Inf/Eff/Sludge) 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)		

Inf Influent

Eff Effluent

^a "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

^b Included with expanded method analyte list.

^c Not the preferred method for this analyte.

Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.

Parameter	Sample Type	Preservation	Maximum Holding Time	Method^a
Temperature	Inf/Eff	None required	Analyze immediately	SM 2550B
pH	Inf/Eff	None required	Analyze immediately	SM 4500-H ⁺ B
BOD ₅	Inf/Eff	Cool, 4 °C	48 hours	SM 5210B
Total Residual Chlorine	Eff	Fill completely	Analyze immediately	Hach 8167
DO Electrode	Eff	None required	Analyze immediately	SM 4500-O G
Suspended solids	Inf/Eff	Cool, 4 °C	7 days	EPA 160.2
Total solids	Sludge	Cool, 4 °C	7 days	SM 2540G
Enterococci	Inf/Eff	Cool, 4 °C, Na ₂ S ₂ O ₃ in effluent	24 hours	SM 9230C
Asbestos	Inf/Eff	Cool, 4 °C, dark	Filter within 48 hours of receipt at lab	EPA 100.1/100.2
	Sludge	Cool, 4 °C	28 days	Polarized Light Microscopy (PLM)
Fecal Coliform Bacteria	Eff	Cool, 4 °C 0.008% Na ₂ S ₂ O ₃	6 hours	SM 9221E
Total Ammonia as N	Eff	Cool, 4 °C, H ₂ SO ₄ to pH <2	28 days	Hach 8038
Total Hydrocarbons as Oil and Grease	Inf/Eff	Cool, 4 °C, dark HCl to pH<2	28 days	EPA 1664 HEM ^b
Volatile Organics	Inf/Eff	Cool, 4 °C, dark, HCL to pH<2 L- Ascorbic Acid in effluent	14 days	EPA 624
	Sludge	Cool, 4 °C	14 days	SW 8260B
Dioxins	Inf/Eff	Cool, 4 °C	30 days until extraction/45 days after extraction	SW 8280A
	Sludge	Cool, 4 °C	30 days until extraction/45 days after extraction	SW 8280A
Semi-Volatile Organics	Inf/Eff	Cool, 4 °C, dark L- Ascorbic Acid in effluent	7 days until extraction/40 days after extraction	EPA 625
	Sludge	Cool, 4 °C	14 days until extraction/40 days after extraction	SW 8270C
Pesticides & PCBs	Inf/Eff	Cool, 4 °C, L- Ascorbic Acid in effluent	7 days until extraction/40 days after extraction	EPA 614 and EPA 608
	Sludge	Cool, 4 °C	14 days until extraction/40 days after extraction	SW 8141A/8081A SW 8082

Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.
(continued)

Parameter	Sample Type	Preservation	Maximum Holding Time	Method ^a
Cyanide (total)	Inf/Eff	Cool, 4°C, NaOH to pH>12, 0.6 g L- Ascorbic acid (in effluent)	14 days	SM 4500 CN,E Mod
	Sludge	Cool, 4°C	14 days	EPA 9010B Mod
Arsenic	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Beryllium	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Cadmium	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Chromium	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Copper	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Lead	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Mercury	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	28 days	EPA 245.1
	Sludge	Cool, 4°C	28 days	SW 7471A
Nickel	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Selenium	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Silver	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Zinc	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Antimony	Inf/Eff	Cool, 4°C, HNO ₃ to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Thallium	Inf/Eff	Cool, 4°C, HNO ₃ to pH <2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020

^a Unless otherwise noted, "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 20th Ed., 1998. "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

^b EPA, 1999a. Document No. EPA-821-R-98-002.

Inf Influent
Eff Effluent

Initial WET testing was performed as a screening period over the course of three quarters during each of which three toxicity tests were performed; each with one vertebrate and two invertebrate species. These screening tests were performed during the third and fourth quarters of 2000 and the first quarter of 2001. Screening included the vertebrate *Atherinops affinis* (topsmelt) for survival and growth; an invertebrate bivalve species (either *Mytilus* spp. [mussel; survival and growth] or *Crassostrea gigas* [oyster; larval development]; and an invertebrate echinoderm species fertilization test (*Strongylocentrotus purpuratus* [purple urchin] or *Dendraster excentricus* [sand dollar]). Once the screening period was completed, the single most sensitive species (bivalve) was used for subsequent toxicity testing until re-screening was performed. As required by the permit, re-screening must be performed each year during one quarter (different than the previous year) to determine the most sensitive species to use for continued testing. Re-screening was performed in the second quarter of 2002 and the third quarter of 2003, with bivalves found to be the most sensitive species. Re-screening that was performed during the fourth quarter of 2004, the third quarter of 2005, the fourth quarter of 2006, and the third quarter of 2007 found the purple sea urchin to be the most sensitive species.

Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units, $TUC = 100 / \text{No Observed Effect Concentration [NOEC]}$). Accelerated testing will include the implementation of the initial investigation Toxicity Reduction Evaluation (TRE) workplan along with at least one additional toxicity test. If the investigation indicates the source of toxicity (e.g., a plant upset), and no toxicity greater than 143 TUC is observed in this test, the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed, then accelerated testing will continue with six more tests performed on a biweekly basis over a 12-week period. Testing will commence within two weeks of receipt of the sample results of the exceedance. If no toxicity greater than 143 TUC is observed in these tests, then the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed in any of the six tests, then a TRE will be initiated within 15 days of receipt of the sample results of the exceedance. A Toxicity Identification Evaluation (TIE) may also be initiated as part of the overall TRE process, and if this is initiated during the accelerated testing period, the accelerated testing schedule may be terminated or used as necessary in performing the TIE.

Toxicity testing was performed as described in Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms (EPA, 1988) and the 'West Coast Marine Methods Manual', First Edition (EPA, 1995) as required by the Permit. The presence of chronic toxicity was estimated as described by these references. Quality assurance for the toxicity testing included the testing of a series of five dilutions and a control, including the concentration of the effluent at the edge of the ZID (0.70 %) as well as two dilutions above and two dilutions below 0.70 %. Reference toxicants were tested concurrently with the effluent testing, using the same procedures. If the effluent tests did not meet all the acceptability criteria as specified in the referenced methods, then the effluent was re-sampled and re-tested as soon as possible. Control and dilution water was natural or synthetic seawater as called for by the referenced methods. If the dilution water was different from the culture water, a second control using culture water will be run. Dilution water met test acceptability criteria.

As part of the WET testing, an initial investigation TRE plan was prepared and submitted to EPA under separate cover (Kinnetic Laboratories, Inc., 2000b). This plan describes the events that will occur should chronic toxicity be detected. As required by the permit and the manual Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants (EPA, 1999b), a preliminary TRE will be initiated within 15 days of the receipt of sample results of the

permit exceedance. A more detailed TRE workplan will subsequently be developed to more fully investigate and identify the cause of the toxicity, identify and provide a schedule of the actions that AWWU will use to mitigate the impact of the discharge, and to prevent the recurrence of the toxicity. As noted above, the TIE may be initiated as part of the overall TRE process during the accelerated testing schedule.

2.1.5 Part 503 Sludge Monitoring

Operations at the Asplund WPCF include a sludge incinerator that is subject to regulation under 40 CFR Part 503—Standards for the Use or Disposal of Sewage Sludge (Part 503). The current permit requires sludge monitoring twice per year, once during the dry conditions in summer and once during wet conditions as noted above. There are no Part 503 monitoring requirements included in the reissued permit because EPA Region 10's current policy is to remove these requirements from NPDES permits with the intention of writing "sludge only" permits in the future. However, the Part 503 regulations are "self-implementing" in that the facility is required to meet the monitoring requirements in the regulation whether they are specifically included in a permit or not. Therefore, monitoring at the Asplund WPCF includes Part 503 monitoring of sludge. Monitoring frequencies required by 40 CFR Part 503 for incineration are once per 60 days for arsenic, cadmium, chromium, lead, and nickel. Frequency required for mercury is at least once per year. Frequency for beryllium is not specified. AWWU has chosen to also test for mercury and beryllium once per 60 days, more frequently than required, so as to be consistent with the testing frequency for the other metals. Allowable limits are site-specific and were calculated per Part 503 regulation in the *Air Operating Permit Application* submitted by AWWU to ADEC in December 1997 (CH2M Hill, 1997). While methods for this monitoring component have been described elsewhere (AWWU, 2000) and results of the monitoring have been provided under separate reporting requirements to EPA, the data are also included in this report.

2.2 RECEIVING WATER QUALITY MONITORING

2.2.1 Water Quality Sampling

As called for by the permit, water quality must be monitored annually during the summer in dry weather conditions (Table 1). Sampling was performed at non-fixed stations made during consecutive ebb and flood tides at the outfall station and a single flood tide at the control station. Station locations were determined by following the track of drogues released above the diffuser at the outfall station and at the control station located north across Knik Arm from Point Woronzof, directly off Point MacKenzie in a similar water depth as the outfall. Three drogue tracks on each tide were performed at each location. Four stations were sampled on each drogue track:

- | |
|--|
| <ul style="list-style-type: none">✓ determine compliance with the NPDES permit and State of Alaska water quality criteria✓ aid in assessing the water quality at the discharge point✓ determine compliance with the regulatory criteria of Section 301(h) for the CWA✓ determine the level of bacterial contamination in nearshore waters✓ provide data for evaluation of permit re-issuance |
|--|

- above the diffuser
- as close to the ZID boundary as practicable
- at least one station in the channel of Knik Arm
- in the shallow subtidal area before the drogue grounds.

As noted in the permit, the ZID is defined as the water column above the area delineated by the sector of a circle with the center located over the outfall, 30 meters (m) shoreward of the diffuser, 650 m in radius, and with a 220° angle (Figure 3).

The plume location was followed by using a holey-sock drogue (Figure 4). The drogue consisted of a six-foot cylindrical nylon tube ballasted at the bottom with a two-pound weight and attached at the top with a bridle to a spherical float. This float was attached to the tracking spar via a connecting line. These cylindrical or spherical designs that enclose a parcel of water have been found to more accurately follow the ambient current patterns than other drogue designs such as the window shade design (Sombardier and Niiler, 1994).

Sampling was performed by positioning the vessel over the diffuser (or control station) for the first sampling station of the drogue track. The drogue was released at approximately the same time and followed until navigation information indicated that the ZID had been reached, at approximately 650 m from the outfall, at which time the ZID boundary station was sampled. The third and fourth stations along each drogue track were sampled as the drogue traveled through the channel in Knik Arm or as it slowed in shallow water prior to grounding. Navigation was accomplished using a differential global positioning system (DGPS). If DGPS coordinates were unavailable, a standard GPS receiver was used to obtain navigational information.

Samples were collected for the parameters outlined in Table 5. The surface waters of all stations were sampled for fecal coliform, color, turbidity, and TRC. Surface samples were collected by grabbing directly into the appropriate sample bottles at sample depth (15 - 30 centimeters [cm]). Mid-, and bottom depth turbidity samples were collected at all stations using Niskin[®] bottles. Mid- and bottom depths were determined at each station using the survey vessel's fathometer. Samples were collected as simultaneously as possible at all three target depths. Hydrographic profiles of temperature, salinity, DO, and pH were collected at all stations using a Seabird SEACAT[®] CTD (conductivity, temperature, and depth) recorder. This instrument was also equipped with a DO, pH, and turbidity sensors to allow profiles of these parameters to be recorded. Samples for the analysis of total and dissolved metals, TSS, hydrocarbons (PAH), and total volatile aromatic hydrocarbons (TAH) were collected from surface waters at the first three stations (diffuser, ZID boundary, and channel) along the first flood drogue track at both the outfall and control stations. These samples were collected directly into the appropriate sample containers. A single replicate sample for each parameter or a single profile was collected at each station except for quality control samples, which are described in Section 4.2.

Samples were analyzed following the methods provided in Table 6. Samples were appropriately labeled at time of collection using pre-prepared, project-specific sample labels as described in Section 2.5 and prepared for shipment to the laboratory. Preservation and maximum holding time information for each of these methods is also provided in Table 6. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

2.2.2 Intertidal Bacterial Sampling

As part of the water quality monitoring effort, intertidal sampling for fecal coliform bacteria was also performed at eight intertidal stations provided in Table 7 and depicted in Figure 3. Two

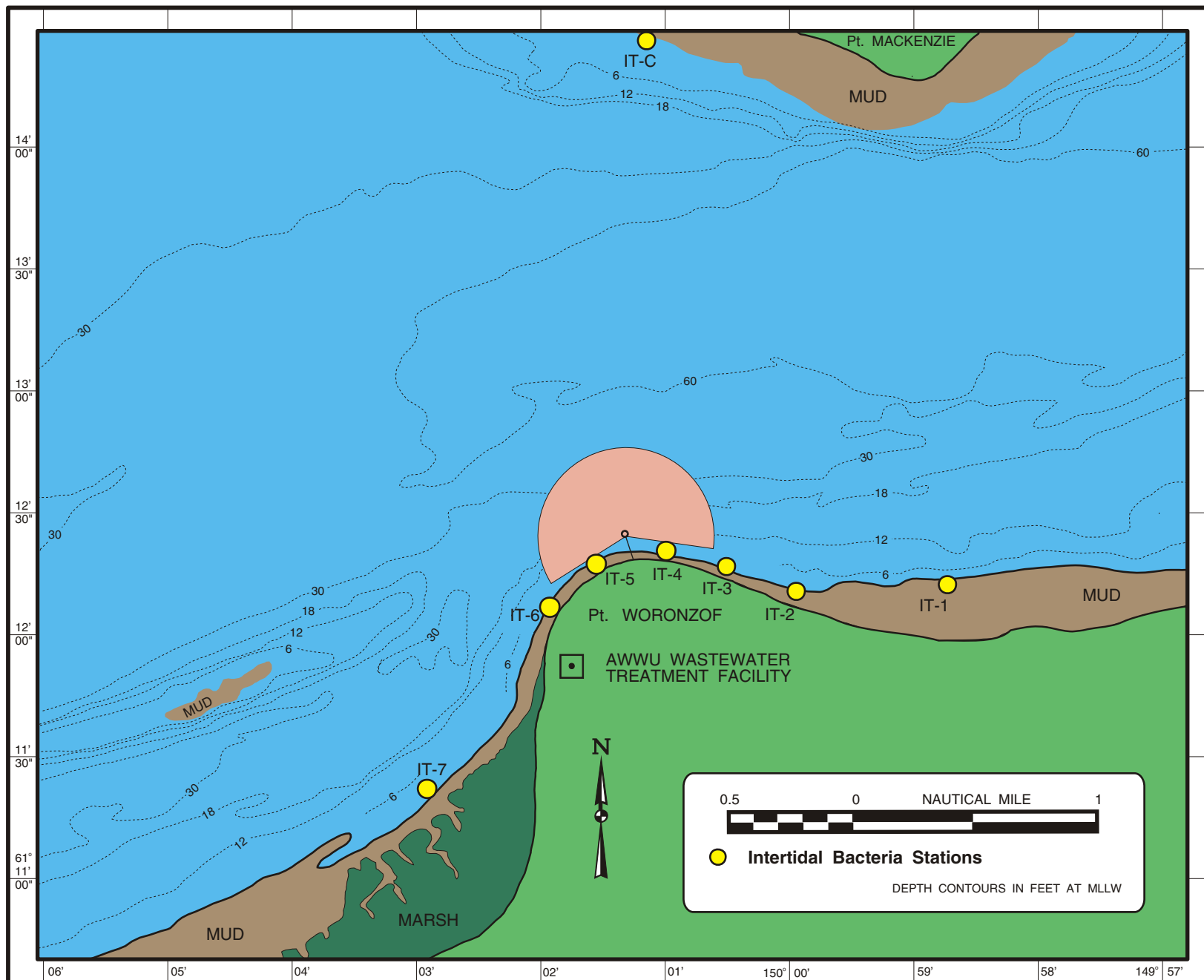


Figure 3. Asplund WPCF Outfall, ZID, and Locations of Intertidal Bacteriological Sampling.

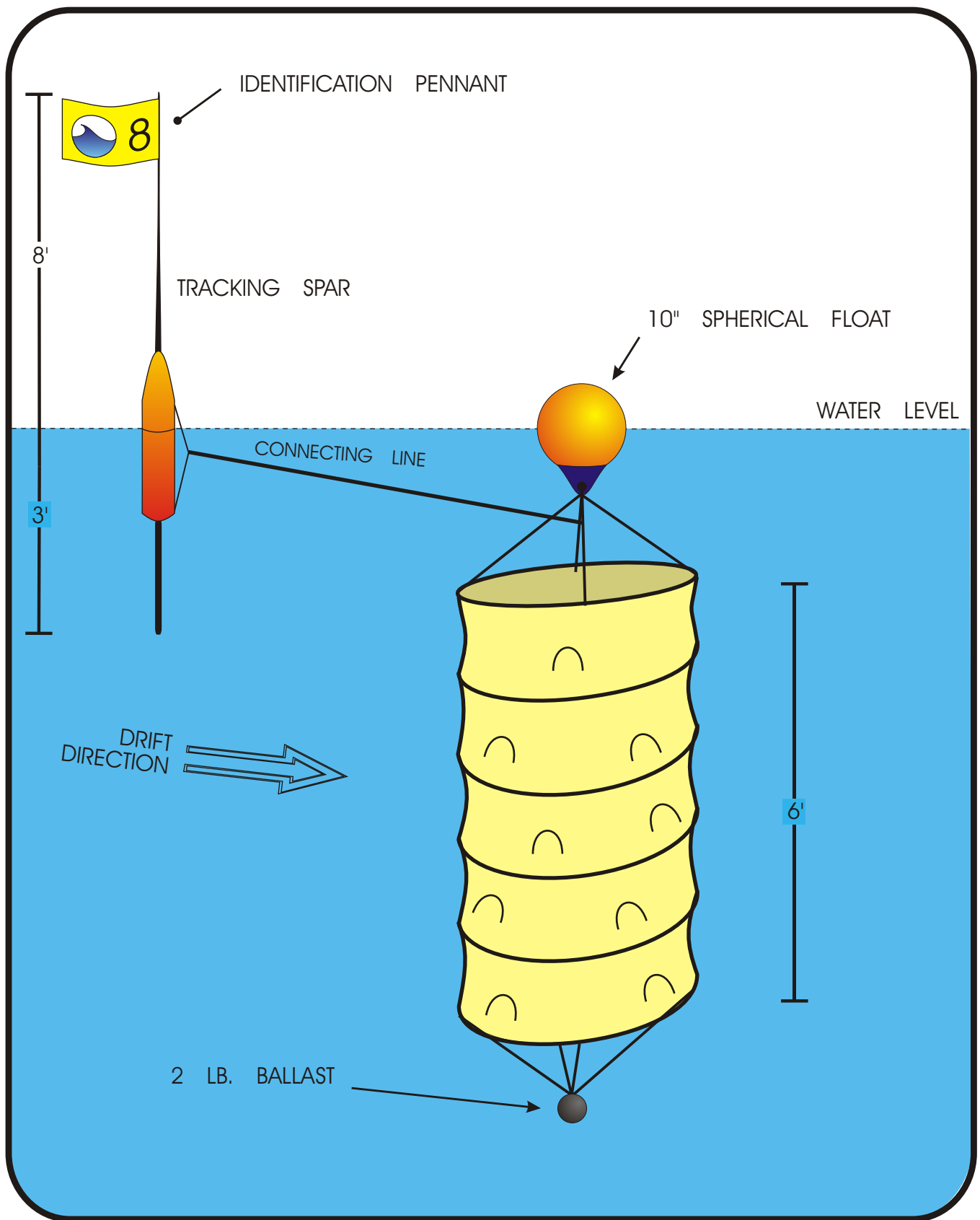


Figure 4. Holey-Sock Drogue, Flotation, and Marker Buoy.

Table 5. Receiving Water Quality Monitoring Requirements.

Parameter	Sampling Depth		
	Surface (above 0.5 m)	Surface, Mid-, and Bottom	Profile (1- to 3-m intervals)
Fecal Coliform	all stations ^a , within the 15-30 cm layer		
Color	all stations, within the 15-30 cm layer		
Total Residual Chlorine (TRC)			
Field Observations: presence or absence of floating solids, visible foam (other than trace), oil wastes, and/or sheen	all stations where surface samples are collected		
Total Aqueous Hydrocarbons (TAqH)	first three stations along the first flood drogue track at both the outfall and control locations		
Total Aromatic Hydrocarbons (TAH)			
Metals and Cyanide ^b			
Total Suspended Solids (TSS)			
Turbidity		all stations	
pH			all stations
Temperature			
Dissolved Oxygen (DO)			
Salinity			

^a Non-fixed stations were sampled following the track of drogues released at the diffuser (outfall station) or at a fixed station having the same depth due north across Knik Arm from Point Woronzof near Point MacKenzie (control station). Three drogue tracks were made during each of a consecutive flood and ebb tide at the outfall station. Stations included the following along each outfall drogue track: above the diffuser; as close to the ZID boundary as possible; one near-field station in the channel of Knik Arm; and a far-field station along the drogue path or in the shallow subtidal area before the drogue grounds. Three drogue tracks were also made during a flood tide at the control station in conjunction with or as soon as practicable as the sampling at the outfall station.

^b Metals include arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc; these were analyzed and reported as total recoverable metals and dissolved metals.

Table 6. Methods, Preservation, and Maximum Holding Times for the Analysis of Receiving Water Quality Samples.

Parameter	Method ^a	Preservation	Maximum Holding Time
Fecal Coliform	SM 9221E	Cool, 4°C, dark	24 hours
Color	SM 2120B	Cool, 4°C, dark	48 hours
Total Residual Chlorine (TRC)	SM 4500-Cl D	None	Analyze immediately
Turbidity	SM 2130B	Cool, 4°C, dark	24 hours
Total Aqueous Hydrocarbons (TAqH)	EPA 602 plus xylenes	Cool, 4°C, HCl to pH<2, L- Ascorbic Acid in presence of chlorine	14 days
	EPA 610	Cool, 4°C, dark, L- Ascorbic Acid in presence of chlorine	7 days until extraction/ 40 days after extraction
Total Aromatic Hydrocarbons (TAH)	EPA 602	Cool, 4°C, HCl to pH<2 L- Ascorbic Acid in presence of chlorine	14 days
Metals (Total Recoverable and Dissolved)	See note ^b	Cool, 4°C, HNO ₃ to pH <2 (after filtration for dissolved)	28 days
Cyanide	EPA 335.2	NaOH, 4°C	14 days
Total Suspended Solids (TSS)	EPA 160.2	Cool, 4°C	7 days
Dissolved Oxygen (DO)	SM 4500-O G (electrode)	None	<i>in situ</i>
pH	SM 4500-H ⁺ B	None	<i>in situ</i>
Temperature	SM 2550B ^c	None	<i>in situ</i>
Salinity	SM 2520B ^c	None	<i>in situ</i>

^a "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020, or 40 CFR 136. "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 20th ed., 1998.

^b Dissolved metals were filtered before acidification; total recoverable metals were digested by ASTM Method D4309-91. Cadmium, chromium, copper, nickel, lead, and zinc were subject to pre-concentration by chelation following EPA Method 1640 prior to analysis by inductively coupled plasma mass spectroscopy. These metals, along with antimony, beryllium, selenium, and thallium, were analyzed as total recoverable and dissolved metals as appropriate for ICP/MS (EPA Method 1638). Mercury was analyzed using cold vapor atomic fluorescence following EPA Method 1631. Arsenic was determined in all samples by flame ionization atomic spectroscopy (SW846 Method 7062). Silver was determined by graphite furnace atomic absorption (EPA Method 200.9).

^c Modified for *in situ* measurements collected with the CTD.

Table 7. Approximate Locations of Intertidal Bacteria Sampling Stations.

Station	Station Location Relative to Diffuser	Latitude (N)	Longitude (W)
IT-1	2000 m east	61° 12' 10"	149° 58' 55"
IT-2	1200 m east	61° 12' 11"	149° 59' 50"
IT-3	750 m east	61° 12' 15"	150° 00' 20"
IT-4	250 m east	61° 12' 19"	150° 00' 52"
IT-5	250 m southwest	61° 12' 15"	150° 01' 10"
IT-6	750 m southwest	61° 12' 02"	150° 01' 28"
IT-7	2000 m southwest	61° 11' 22"	150° 02' 02"
IT-C	Across Knik Arm from the diffuser	61° 14' 26"	150° 01' 09"

replicate water samples were collected from each station at slack high water when the water depths were between 1 to 3 feet (ft). Additional quality control samples were collected as described in Section 4.2. Samples were collected by grabbing from 15 - 30 cm depths directly into the appropriate container. Samples were analyzed using the same procedures described above and in Table 6.

In addition to the required intertidal samples, two replicated fecal coliform samples were also collected once during the water quality monitoring effort from three area streams that empty into Knik Arm: Ship, Chester, and Fish Creeks. Samples were analyzed using the same procedures described previously and in Table 6.

At time of collection, all fecal coliform samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.5. All samples were collected in the appropriate precleaned sample containers, dechlorinated, and preserved, if necessary, as described by the method. Samples were placed on gel ice immediately after sampling and remained chilled during transport to the laboratory. Field notes, including navigational and sampling information, were recorded on project-specific field logs. As required by the permit, field observations taken at each station included the presence or absence of floating solids, visible foam in other than trace amounts, oily wastes, or sheen. Weather observations were also recorded. All field documentation was reviewed by the field leader at the completion of the survey. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

2.2.3 Vessel Support

The *NORTH FORTY*, a 26-ft KLI-owned survey vessel, was used for drogue tracking and water sampling in 2007. In addition, a 14-ft Zodiac[®] was used to retrieve grounded drogues and conduct intertidal bacteria sampling. The Zodiac[®] was also used to transport samples with short holding times (i.e., bacterial samples) ashore.

2.3 SEDIMENT AND BIOACCUMULATION MONITORING

As stipulated in the NPDES permit, sediment and bioaccumulation monitoring was to be performed during the fourth year after the effective date of the permit. Intertidal and subtidal sediment sampling was performed in conjunction with the 2003 receiving water monitoring sampling. Bioaccumulation sampling was performed during 2004.

2.4 LABORATORY ANALYSIS

Laboratory analyses of all samples for this program followed preservation and analysis procedures described by EPA-accepted protocols as referenced in this document (Table 4 and Table 6). These procedures are fully described by the referenced documents and/or 40 CFR 136.

2.5 DOCUMENTATION PROCEDURES

All field and sampling data were recorded on appropriate pre-printed project-specific field data forms. Field data forms included drogue tracking forms, water sampling log forms, sample identification/chain of custody forms, and sample labels. These forms were tailored to the monitoring program to facilitate accurate and complete documentation of field activities. The field task leader was responsible for review and approval of all field documentation; this was completed as soon as possible after sampling.

Sampling logs included specific information such as station identification, sample identification numbers, navigational data, sampling or photographic observations, sampling depths, and collection date and time. Names of personnel performing the sampling were recorded on each log. Drogue tracking logs included station identification information along with navigational data to allow the track of each drogue to be determined and plotted. Pre-printed labels included such information as station designation, analysis type, date of collection, sampling personnel, and a pre-assigned sample identification number to uniquely identify each sample. Quality control samples were labeled as were regular environmental samples so as to be blind to the laboratory analysts.

Sample identification and integrity was ensured by a rigidly-enforced chain of custody program. Sample identification/chain of custody (COC) forms provided specific information concerning the identification, handling, and shipment of samples.

Pertinent information from the sample label was transferred onto the COC, along with other information as required. COC forms were completed, signed by field personnel, and copied if needed. In some cases, where photocopying was not convenient or possible, two-part carbonless forms were used. The original of each COC form was packed with the samples in coolers for shipment to the laboratory. The field task leader retained a copy of each form for the field records and for tracking purposes should a shipment become lost or delayed. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian signed the samples in by checking all sample labels against the COC information and noting any discrepancies as well as sample condition (e.g., containers leaking or damaged during shipment). Internal sample tracking procedures at the laboratory were initiated immediately upon receipt of samples as described by each laboratory's standard operating procedures.

3.0 RESULTS

3.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING

3.1.1 Monthly Discharge Monitoring Data

Results of AWWU's daily, weekly, and monthly sampling of influent and effluent for non-metals are presented as monthly summaries in Table 8. Averages are based on the 12-month period from January through December 2007.

Removal of BOD₅ averaged 35 % for the year, and removal of TSS averaged 75 % for the 12-month reporting period. These averages exceed the minimum values required by the amendments to the CWA (40 CFR Part 125.60; Final Rule, 8/9/94), whereby dischargers with 301(h) waivers are required to remove 30 % of BOD₅ and 30 % of the suspended solids. On a monthly average basis, the removal of BOD₅ ranged from 30 to 43 % removal with no values violating the limit in 2007. The highest monthly average effluent BOD₅ was 174 mg/L, substantially less than the permit limitation of 240 mg/L. All of the BOD₅ values (daily, weekly, and monthly averages) reported for the calendar year 2007 met the permit limitations. Total suspended solids concentrations in the effluent were low and typical of those seen historically at the Asplund WPCF with the highest monthly average effluent concentration of 66 mg/L compared to the permit limit of 170 mg/L. The yearly average TSS was 57 mg/L. Weekly average and daily maximum TSS also met permit requirements.

The highest mean monthly fecal coliform bacteria count was 76 FC MPN/100 mL in July 2007. All of the months in 2007 met the permit limitation of 850 FC MPN/100 mL based on a geometric mean of at least five samples, which ranged from 3 to 76 FC MPN/100 mL, well below the permit limitation. The criterion of not more than 10 % of the samples analyzed should exceed 2,600 FC MPN/100 mL was met 11 months out of 12 in 2007. This criterion was not met in May (2 of 14 samples or 14 % exceeded). Exceedances resulted from a combination of factors which made maintaining an optimal chlorine disinfection level difficult. This included wastewater with an unusually high chlorine demand at times interspersed with periods of low demand due to increased rainfall. The chlorine feed control system is discussed below in Section 5.1.1. All fecal coliform exceedances were reported to EPA on the discharge monitoring reports (DMRs) as required.

The TRC daily maximum limit met the permit-required limitation of 1.2 mg/L this year, with a maximum daily value of 1.11 mg/L and a monthly range of 0.59 to 1.11 mg/L. The monthly averages of TRC concentrations ranged from 0.25 to 0.57 mg/L, with an overall average of 0.38 mg/L. The permit requirement that effluent pH remain between 6.5 and 8.5 standard units was always met, exhibiting a minimum and maximum range of 6.5 to 7.9 pH units for the year.

Although other parameters such as DO, temperature, and ammonia do not have permit limitations, ranges were typical of those seen historically. DO in the effluent exhibited monthly averages ranging from 1.5 to 6.1 mg/L, with a yearly average of 3.7 mg/L. Temperature showed yearly averages of 11.8 and 11.9 °C in the influent and effluent, respectively. Monthly values for total ammonia in effluent ranged from 17.2 to 22.9 mg/L, with a yearly average of 19.3 mg/L.

Table 8. Discharge Monitoring Data for Influent and Effluent Non-Metals.

Month	Average EFF Flow Rate (MGD)	Temperature Average (°C)		pH Minimum/ Maximum (pH) ^a		TRC Average (mg/L)		DO Average (mg/L)		BOD ₅ Average (mg/L)			Total Susp. Solids Average (mg/L)			Fecal Coliform Average (MPN/100 mL)		Total Ammonia Average (mg/L)	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	REM (%)	INF	EFF	REM (%)	INF	EFF	INF	EFF
01/07	25.7	9.8	10.3	6.6/7.8	6.6/7.6	NT	0.44	NT	4.9	232	149	36	217	50	77	NT	6	NT	20.0
02/07	25.1	10.2	10.3	6.6/8.0	6.6/7.8	NT	0.47	NT	5.6	242	169	30	211	54	74	NT	6	NT	19.8
03/07	25.1	9.7	9.9	6.7/7.8	6.6/7.4	NT	0.36	NT	6.1	232	156	33	218	53	76	NT	6	NT	20.2
04/07	32.3	9.4	9.9	6.7/7.8	6.6/7.7	NT	0.57	NT	6.1	192	133	31	203	56	72	NT	30	NT	17.4
05/07	28.0	10.2	10.4	6.7/7.8	6.6/7.5	NT	0.43	NT	5.3	227	150	34	237	62	74	NT	47	NT	19.3
06/07	26.6	11.8	11.9	6.7/7.7	6.6/7.5	NT	0.36	NT	2.7	238	158	34	245	66	73	NT	7	NT	19.4
07/07	26.1	13.6	13.9	6.7/7.9	6.5/7.9	NT	0.25	NT	2.9	279	174	38	284	65	77	NT	76	NT	18.8
08/07	27.5	14.6	15.3	6.6/7.6	6.5/7.3	NT	0.32	NT	2.2	253	162	36	264	62	76	NT	12	NT	20.6
09/07	29.4	14.6	15.4	6.6/7.8	6.5/7.4	NT	0.36	NT	2.4	216	131	39	232	59	75	NT	12	NT	17.2
10/07	28.6	14.0	13.6	6.7/7.9	6.6/7.4	NT	0.25	NT	1.5	246	141	43	240	57	76	NT	3	NT	19.0
11/07	28.0	12.3	12.0	7.1/7.4	7.0/7.4	NT	0.37	NT	1.9	209	128	39	220	53	76	NT	5	NT	22.9
12/07	28.4	11.3	10.4	7.3/7.5	7.0/7.2	NT	0.40	NT	2.9	180	124	31	195	48	75	NT	9	NT	17.2
Average	27.6	11.8	11.9	6.6/8.0	6.5/7.9	---	0.38	---	3.7	229	148	35	231	57	75	---	18	---	19.3

^a Monthly or Yearly (minimum-maximum)

NT Not tested (tested in effluent only)

REM Percent Removal

--- Not applicable

3.1.2 Toxic Pollutants and Pesticides Analyses

Toxic pollutant and pesticide monitoring for influent, effluent, and sludge was conducted on 19 - 20 June 2007 for summer-dry weather and 7 - 8 August 2007 for the summer-wet sampling. Sampling was performed over a 24-hr period by AWWU personnel.

Results of the toxic pollutant and pesticide analyses are provided in Table 9 (June 2007) and Table 10 (August 2007). For semi-volatile organic compounds (EPA Methods 625/8270C), volatile organic compounds (EPA Methods 624/8260B), and pesticides (EPA Methods 608/8081A and 614/8141A), only those pollutants that were detected in the influent, effluent, or sludge are listed. Refer to Appendices A and B for the laboratory reports and a complete listing of toxic pollutants and pesticides analyzed. A number of the constituents were found only in the sludge. Pollutants found in the influent were often detected in the effluent, and vice versa. In general, pollutant concentrations were low and many of the concentrations reported for the two samplings were below method detection limits (MDLs) or method reporting limits (MRLs).

Percent removal rates shown in these tables were computed from influent and effluent concentration values. Percent removal was only calculated for compounds where a concentration in the influent and/or effluent was reported at a level above the MDL or MRL. Compounds with estimated concentrations (denoted with a "J" qualifier) were not used for percent removal calculation unless a non-estimated concentration was reported for that compound in the other type of sample (influent or effluent). The reported MDL or MRL was used for calculations where necessary (where a compound was reported as non-detect [ND]). Where several laboratory duplicate analyses were performed for a parameter, a percent removal is provided for each duplicate. For summed values, such as the total aromatic hydrocarbons defined as BETX, the MRL or MDL was used for values reported as not detected (ND).

Some of the pollutant removal rates were actually negative values due to the higher concentrations found in the effluent or where a compound was detected in the effluent but not the influent. Both positive and negative removals can be caused by effluent samples being more homogenous due to mixing in the clarifiers, whereas detecting a point-source pollutant in the influent is often more variable. Also, there is a residence time for the effluent in the plant, along with the addition of approximately 1 million gallons/day of well water and city water in the treatment process, therefore the influent does not correspond directly with the effluent.

The types and concentrations of measured organic compounds varied considerably between the two sampling periods. Compounds that were detected in both the influent and effluent samples during at least one of the sampling events included benzene, bis (2-ethylhexyl) phthalate, diethyl phthalate, 1,4-dichlorobenzene, ethylbenzene, chloroform, methylene chloride, phenol, tetrachloroethene, toluene, and total xylenes. Many of these compounds were estimated values that were below their reporting limits and therefore were qualified with a J. Methylene chloride was seen in the blank in August. This compound is a common laboratory contaminant that has been noted in the past; these data were appropriately qualified with a B indicating potential laboratory contamination. Although not detected in the method blanks, diethyl phthalate is another common laboratory contaminant that was seen in the influent and effluent during June. Compounds that were seen in the sludge as well as the influent and effluent during the June 2007 sampling included estimated (below MDL) concentrations of chloroform and benzene along with

Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 19 and 20 June 2007.

Pollutant	Influent^a (µg/L)	Effluent^a (µg/L)	Sludge^a (µg/g)	Percent Removal
VOLATILES (EPA Methods 624/SW 8260B) – detected substances only				
Benzene	0.30 J	0.58 J	0.016 J	---
Chloroform	4.3 J	3.4 J	0.015 J	---
Ethylbenzene	0.56 J	2.9 J	0.140	---
Methylene Chloride	3.2 J	3.1 J	ND (0.091)	---
Toluene	9.3	21	1.900	-126
Xylenes (total)	3.3 J	23	0.820	-597
1,3- Dichlorobenzene	ND (5.0)	9.5	ND (0.091)	-90
1,4- Dichlorobenzene	ND (5.0)	9.5	0.440	-90
1,1,2,2-Tetrachloroethane	ND (5.0)	3.3 J	ND (0.091)	---
Tetrachloroethene	0.95 J	6.4	0.280	-574
Trichloroethene	ND (5.0)	ND (5.0)	0.0042 J	---
SEMI-VOLATILES (EPA Methods 625/SW 8270C) – detected substances only				
Bis (2-ethylhexyl) phthalate	15 J	20 J	15	---
Diethyl phthalate	9.3 J	10 J	ND (25)	---
Phenol	74	24 J	ND (13)	68
HYDROCARBONS				
Oil & Grease (EPA 1664-HEM)	70700	14900	NT	79
Total Aromatic Hydrocarbons as BETX from EPA Method 624	13.5	47.5	2.876	-252

Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 19 and 20 June 2007. (continued)

Pollutant	Influent^a (µg/L)	Effluent^{a,b} (µg/L)	Sludge^a (µg/g)	Percent Removal
DISSOLVED METALS				
Antimony	ND (3.00)	ND (3.00)/ ND (3.00)	NT	---
Arsenic	1.35	1.93 / 1.95	NT	-43 / -44
Beryllium	ND (1.00)	ND (1.00) / ND (1.00)	NT	---
Cadmium	ND (1.00)	ND (1.00) / ND (1.00)	NT	---
Chromium	1.28	1.32/ 1.50	NT	-3 / -17
Copper	20.0	25.4 / 25.2	NT	-27 / -26
Lead	ND (1.00)	ND (1.00) / ND (1.00)	NT	---/---
Mercury	ND (0.200)	ND (0.200)	NT	---
Molybdenum	8.77	9.95/10.2	NT	-13/-16
Nickel	3.37	3.24/3.33	NT	4 / 1
Selenium	1.24	ND (1.00)/ ND (1.00)	NT	19/19
Silver	ND (1.00)	1.01 / 1.07	NT	-1 /-7
Thallium	ND (1.00)	ND (1.00) /ND(1.00)	NT	---
Zinc	21.1	48.7 / 48.0	NT	-131 / -127
TOTAL METALS				
Antimony	ND (3.00)	ND (3.00)	ND (4.98)	---
Arsenic	2.31	2.18	3.69	6
Beryllium	ND (1.00)	ND (1.00)	ND (1.66)	---
Cadmium	ND (1.00)	ND (1.00)	ND (1.66)	---
Chromium	3.24	2.09	13.3	35
Copper	64.4	40.7	181	37
Lead	3.78	2.08	9.76	45
Mercury	ND (0.200)	ND (0.200)	1.03	---
Molybdenum	10.5	10.8	ND (8.30)	-3
Nickel	5.25	3.91	10.0	26
Selenium	ND (1.00)	ND (1.00)	2.24	---
Silver	2.57	2.22	12.3	14
Thallium	ND (1.00)	ND (1.00)	ND (3.32)	---
Zinc	138	83.8	420	39

Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 19 and 20 June 2007. (continued)

Pollutant	Influent ^{a,b} (µg/L)	Effluent ^{a,b} (µg/L)	Sludge ^{a,b} (µg/g)	Percent Removal
PESTICIDES (EPA Methods 608/SW8081A/8082, 614/SW 8141A) – detected substances only				
Dieldrin	ND (0.10)/ ND (0.10)	ND (0.10)	0.0040 J, COL	---/---
Gamma-BHC (Lindane)	ND (0.050)/ ND (0.050)	ND (0.050)	0.0010 J, COL	---/---
Heptachlor	ND (0.050)/ND (0.050)	0.015 J,COL	ND (0.0053)	---/---
ENTEROCOCCI BACTERIA (SM 9230C)				
Enterococci ^c	NT	152 / 108	NT	---
OTHER COMPONENTS				
Asbestos ^d	ND (110.00)	ND (110.00)	ND	---
Cyanide	6.0 J	9.0 J/9.0 J/10.0	1.70/1.60	-50/-50/-66
Dioxin (2,3,7,8-TCDD)	ND (0.000088)	ND (0.000055)	ND (0.000084)	---

a Detection limits or reporting limits are included in parentheses for non-detected (ND) values

b Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)

c Enterococci reported in CFU/100 mL

d Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)

COL More than 40% RPD between primary and confirmation column results. The lower of the two results is reported.

J Estimated value (below MDL or MRL)

--- Not applicable (not calculated)

ND None detected

NT Not tested

Table 10. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 7 and 8 August 2007.

Pollutant	Influent^a (µg/L)	Effluent^a (µg/L)	Sludge^a (µg/g)	Percent Removal
VOLATILES (EPA Methods 624/SW 8260B) – detected substances only				
Benzene	0.33 J	0.27 J	0.013 J	---
Chloroform	2.3 J	3.8 J	ND (0.170)	---
Chloromethane	ND (10)	1.7 J	ND (0.170)	---
1, 4-Dichlorobenzene	1.5 J	0.98 J	0.690	---
Ethylbenzene	2.4 J	0.62 J	0.180	---
Methylene chloride	5.0 B	3.5 J,B	ND (0.085)	---
Tetrachloroethene	4.6 J	2.5 J	1.200	---
Toluene	8.7	8.1	2.700	7
Trichloroethene	ND (5.0)	ND (5.0)	0.0081 J	---
Xylenes (total)	13	3.1 J	1.100	76
SEMI-VOLATILES (EPA Methods 625/SW 8270C) – detected substances only				
Bis (2-ethylhexyl) phthalate	18 J	20 J	33.000 J	---
Phenol	45 J	25 J	ND (110.000)	---
HYDROCARBONS				
Oil & Grease (EPA 1664-HEM)	27500	34500	NT	-25
Total Aromatic Hydrocarbons as BETX from EPA Method 624	24.4	12.1	3.993	50

Table 10. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 7 and 8 August 2007. (continued)

Pollutant	Influent^a (µg/L)	Effluent^a (µg/L)	Sludge^a (µg/g)	Percent Removal
DISSOLVED METALS				
Antimony	ND (3.00)	ND (3.00)	NT	---
Arsenic	1.18	1.69	NT	-43
Beryllium	ND (1.00)	ND (1.00)	NT	---
Cadmium	ND (1.00)	ND (1.00)	NT	---
Chromium	1.67	1.33	NT	20
Copper	21.1	26.9	NT	-27
Lead	1.63	2.34	NT	-44
Mercury	ND (0.200)	ND (0.200)	NT	---
Molybdenum	ND (5.00)	6.19	NT	-24
Nickel	3.25	3.54	NT	-9
Selenium	ND (1.00)	ND (1.00)	NT	---
Silver	ND (1.00)	ND (1.00)	NT	---
Thallium	ND (1.00)	ND (1.00)	NT	---
Zinc	24.4	49.5	NT	-103
TOTAL METALS				
Antimony	ND (3.00)	ND (3.00)	ND (4.10)	---
Arsenic	1.29	1.83	3.93	-42
Beryllium	ND (1.00)	ND (1.00)	ND (1.37)	---
Cadmium	ND (1.00)	ND (1.00)	ND (1.37)	---
Chromium	1.50	1.90	13.7	-27
Copper	30.2	34.8	191	-15
Lead	2.29	3.57	18.9	-56
Mercury	ND (0.200)	ND (0.200)	1.04	---
Molybdenum	5.43	6.81	ND (6.83)	-25
Nickel	3.61	4.05	11.0	-12
Selenium	ND (1.00)	ND (1.00)	2.46	---
Silver	1.22	1.26	7.14	-3
Thallium	ND (1.00)	ND (1.00)	ND(1.37)	---
Zinc	55.1	84.8	532	-54

Table 10. Toxic Pollutants and Pesticides Detected in the Influent, Effluent, and Sludge, Sampled 7 and 8 August 2007. (continued)

Pollutant	Influent^a (µg/L)	Effluent^{a,b} (µg/L)	Sludge^a (µg/g)	Percent Removal
PESTICIDES (EPA Methods 608/SW8081A, SW8082, 614/SW 8141A) – detected substances only				
4,4' - DDD	ND (0.10)	0.047 J	ND (0.058)	---
4,4' - DDE	ND (0.10)	0.016 J, COL	ND (0.058)	---
Endrin	ND (0.10)	0.011 J, COL	ND (0.058)	---
Heptachlor	0.48	0.58	0.210	-21
ENTEROCOCCI BACTERIA (SM 9230C)				
Enterococci ^c	NT	3200 / 3400	NT	---
OTHER COMPONENTS				
Asbestos ^d	ND (22.00)	ND (22.00)	ND	---
Cyanide	11.0/10.0	59.0	2.65	-436/-490
Dioxin (2,3,7,8-TCDD)	ND (0.000072)	ND (0.000040)	ND (0.000071)	---

a Detection or reporting limits are included where possible in parentheses for non-detected (ND) values

b Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)

c Enterococci reported in CFU/100 mL

d Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)

--- Not applicable (not calculated)

B Method blank contamination

COL More than 40 % RPD between primary and confirmation columns results. The lower of the two results is reported.

J Estimated value (below MDL or MRL)

ND None detected

NT Not tested

quantifiable (non-estimated) concentrations of ethylbenzene, toluene, total xylenes, tetrachloroethene, and bis (2-ethylhexyl) phthalate. An estimated concentration of trichloroethene was also seen in the sludge sample for June 2007, but this compound was not detected in the influent or effluent for this sampling event. In August 2007, of those compounds that were detected in both the influent and effluent; benzene, 1,4-dichlorobenzene, ethylbenzene, tetrachloroethene, toluene, total xylenes, and bis (2-ethylhexyl) phthalate were also seen in the sludge. In addition, trichloroethene were detected in the sludge in August 2007, although it was not detected in the influent or effluent during this sampling event. Again, many of these concentrations were estimated and qualified with a J as they fell below method detection or reporting limits.

Oil and grease concentrations measured in the influent and effluent in 2007 using EPA 1664A HEM were similar to those seen in 2006 with effluent concentrations in the range of 15-35 mg/L. Oil and grease effluent concentrations for 2006 were in the range of 19-20 mg/L. Effluent BETX concentrations as measured by EPA 624 were 47.5 and 12.1 µg/L in the June and August 2007 samplings, respectively. Total aromatic hydrocarbons as BETX (EPA 602) and PAHs were also sampled in the effluent as part of the receiving water program. Refer to Sections 5.1 and 5.2 for further discussion of the significance of the total hydrocarbon values.

The AWQS have site-specific criteria for the Point Woronzof area that are based on dissolved metals in the receiving water. These SSWQC were utilized to determine the MAEC (defined as the value specified as the receiving water limit and/or the permit limit multiplied by the initial dilution of 142:1 for conservative substances and 180:1 for non-conservative substances after taking into account the natural background concentration). Both total and dissolved concentrations of metals in the effluent were then compared to the MAECs.

Total metals concentrations in both the influent and effluent were generally found to be low. Influent and effluent concentrations of total antimony, beryllium, cadmium, mercury, selenium and thallium were below detection limits during both sampling periods. Other total recoverable metals such as arsenic, chromium, copper, lead, molybdenum, nickel, silver, and zinc were seen in the influent and effluent during both sampling events, but at very low levels when compared to their respective MAECs.

Dissolved metals concentrations were also generally found to be low. Dissolved antimony, beryllium, cadmium, mercury, and thallium were found to be below detection limits for both influent and effluent during both sampling periods. Dissolved arsenic, chromium, copper, nickel, and zinc were above detection limits in both influent and effluent during both sampling events, while dissolved lead was reported above the detection limit in the influent and effluent only during the August sampling. Dissolved molybdenum was seen at low levels in the influent and effluent during June 2007 and in the effluent during August 2007. Dissolved silver was seen at low concentrations in the effluent during the June 2007 sampling. The concentration for dissolved copper in effluent was found to be the highest of any of the metals with respect to its MAEC of 317 µg/L, with a level of 27 µg/L during the August 2007 sampling, still approximately an order of magnitude less than the MAEC.

Several pesticides were detected in the influent, effluent, or sludge during the June and August 2007 sampling events. Of the pesticides detected, only Heptachlor was detected in both the influent and effluent at concentrations above the MDL during the August 2007 sampling. All other concentrations of pesticides were detected at levels below the MDL (therefore qualified

with a J). Both 4,4'-DDD and 4,4'-DDE were detected in the August effluent at levels below the reporting limit. These are breakdown products of DDT which has been banned from use in the United States since 1972, therefore its existence in AWWU's effluent is suspect and probably due to laboratory error or contamination. No PCBs were detected in either the June or August sampling. For a complete list of the various pesticide analytes, refer to Appendices A2 and B2.

The permit calls for the analysis of enterococci bacteria in effluent twice per year in conjunction with the summer dry and summer wet sampling. The enterococci in the effluent was reported as 152 and 108 most probable number (MPN)/100 mL for the June 2007 sampling and 3,200 and 3,400 MPN/100 mL for the replicates taken during the August 2007 sampling event.

Asbestos was not detected in influent, effluent, or sludge during either sampling event. The concentration of cyanide in the influent and effluent was above the detection limit of 2 µg/L during both the June 2007 and August 2007 sampling events. The highest concentration of cyanide was seen in the effluent during the August sampling event at 59 µg/L. Although higher than seen historically, these concentrations are still well below the MAEC of 181 µg/L. Cyanide was detected in sludge at 1.7 µg/g with a field duplicate value of 1.6 µg/g in June 2007 and at 2.65 µg/g in the August 2007 sampling event. Dioxins (2,3,7,8-TCDD) were tested in influent, effluent, and sludge during both sampling events, but none were detected.

3.1.3 Pretreatment Monitoring Data

As part of the NPDES permit, AWWU is to conduct pretreatment monitoring twice per year in conjunction with the toxic pollutant and pesticide analyses. This monitoring includes three consecutive days of 24-hr composite sampling of the influent and effluent. Pretreatment analyses include cyanide and a suite of metals that are analyzed as both total and dissolved. Results of the pretreatment monitoring are presented in Table 11.

Collection of samples for metals analysis as part of the toxic pollutant and pesticide sampling events in June and August 2007 coincided with the first day of the pretreatment monitoring performed by TestAmerica for the Asplund WPCF during 2007, as discussed in Section 3.1.2. Metals concentrations for the two additional days of each 3-day pretreatment sampling event were typically similar to those discussed above, particularly for the effluent. For example, dissolved copper in the effluent was reported at 27 µg/L during the first two days of pretreatment sampling in August 2007 and at 22 µg/L on the third day of sampling. Influent values were generally more variable than those seen in effluent, as would be expected.

Of all the metals in the effluent, total copper and zinc concentrations were the highest, but values for these metals were still well below their respective MAECs. Dissolved copper in the effluent was found to range from 22 to 29 µg/L for the six pretreatment samples, as compared to the MAEC of 317 µg/L. Total copper in the effluent ranged from 35 - 43 µg/L during the pretreatment sampling. Dissolved zinc in the effluent ranged from 42 - 54 µg/L during both pretreatment samplings, while total zinc ranged from 79 to 105 µg/L during these samplings as compared to an MAEC of 11,249 µg/L. Dissolved and total mercury were below reporting limits in all six effluent pretreatment samples, as compared to the MAEC of 2.73 µg/L. Other metals were also found to be substantially less than their respective MAECs. Total cyanide was detected above the reporting limit (10 µg/L) in four of the six effluent pretreatment samples collected, as compared to an MAEC of 181 µg/L. Total cyanide was detected at 59 µg/L in the effluent during the first day of the August sampling.

Table 11. Pretreatment Monitoring Data for Influent and Effluent Metals and Cyanide.
Concentrations are in µg/L.^a

Parameter	June 2007						August 2007					
	Influent			Effluent			Influent			Effluent		
Sample Date	19	20	21	19	20	21	07	08	09	07	08	09
Dissolved Metals												
Arsenic	1.35	1.34	1.43	1.93/ 1.95	1.90	1.83	1.18	1.24	1.47/ 1.51	1.69	1.53	1.68
Beryllium*	<1.00	<1.00	<1.00	<1.00/ <1.00	<1.00	<1.00	<1.00	<1.00	<1.00/ <1.00	<1.00	<1.00	<1.00
Cadmium	<1.00	<1.00	<1.00	<1.00/ <1.00	<1.00	<1.00	<1.00	<1.00	<1.00/ <1.00	<1.00	<1.00	<1.00
Chromium	1.28	1.40	1.14	1.32/ 1.50	1.35	1.24	1.67	1.07	<1.00/ 1.19	1.33	1.29	1.03
Copper	20.0	20.9	19.7	25.4/ 25.2	26.6	28.8	21.1	18.5	17.9/ 17.8	26.9	26.6	22.4
Cyanide	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Lead	<1.00	<1.00	<1.00	<1.00/ <1.00	<1.00	<1.00	1.63	<1.00	<1.00/ <1.00	2.34	<1.00	<1.00
Mercury	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Molybdenum	8.77	<5.00	<5.00	9.95/ 10.2	<5.00	<5.00	<5.00	<5.00	5.50/ 5.88	6.19	5.91	5.61
Nickel	3.37	3.39	2.75	3.24/ 3.33	3.46	3.23	3.25	3.24	3.24/ 3.20	3.54	3.22	3.38
Silver	<1.00	1.30	<1.00	1.01/ 1.07	<1.00	<1.00	<1.00	<1.00	<1.00/ <1.00	<1.00	1.13	<1.00
Zinc	21.1	19.7	22.1	48.7/ 48.0	53.6	45.5	24.4	20.9	24.0/ 23.9	49.5	52.3	42.3
Total Metals												
Arsenic	2.31	2.15	2.27	2.18	2.14	1.87	1.29	2.95	3.21	1.83	2.51	2.87
Beryllium*	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Cadmium	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chromium	3.24	3.25	3.23	2.09	2.57	2.02	1.50	7.03	3.69	1.90	2.50	2.19
Copper	64.4	54.5	61.7	40.7	39.6	37.8	30.2	93.8	75.7	34.8	41.1	42.6
Cyanide	6.0 J	12.0	10.0	9.0J/9.0J/ 10.0	11.0	13.0	11.0/ 10.0	17.0/ 14.0	25.0/ 25.0	59.0	<10.0	27.0
Lead	3.78	2.60	3.08	2.08	1.71	1.72	2.29	9.89	4.30	3.57	1.77	2.09
Mercury	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	0.864	0.208	<0.200	<0.200	<0.200
Molybdenum	10.5	5.01	6.81	10.8	<5.00	5.47	5.43	6.38	9.45	6.81	6.21	9.49
Nickel	5.25	4.88	4.68	3.91	4.18	3.94	3.61	8.95	5.55	4.05	4.08	4.12
Silver	2.57	3.13	2.96	2.22	1.98	1.75	1.22	2.90	2.91	1.26	1.91	1.61
Zinc	138	126	125	83.8	86.2	79.4	55.1	299	190	84.8	102	105

^a Duplicate lab analyses provided (value/duplicate value)

* Not required by permit for "Pretreatment" monitoring

NT Not tested J Estimated value

Values reported as "<" (less than), are reporting limits

3.1.4 Whole Effluent Toxicity Testing Results

Quarterly WET testing was conducted on 24-hr flow composite effluent samples as required under the permit during all four quarters of calendar year 2007. Echinoderm fertilization tests were performed using the purple sea urchin, *Strongylocentrotus purpuratus*, during the first, second, and fourth quarters of 2007. Use of this test during the first, second, and fourth quarters was based on the screening test results from the fourth quarter of 2006 and the third quarter of 2007, which had determined the sea urchin to be the most sensitive species tested (see Section 2.1.4). Annual re-screening for the most sensitive species in 2007 was performed during the third quarter, and the sea urchin was again found to be the most sensitive species tested.

Results of all the tests performed in 2007 are summarized below and presented in Table 12 as the lowest observed effect concentration (LOEC), no observed effect concentration (NOEC), and in chronic toxicity units (TUc), where $TUc = 100/NOEC$. Detailed results in the form of descriptive laboratory reports that present all data in tabular form along with statistical analyses, QA/QC information, and reference toxicant test results have previously been submitted to EPA with the monthly DMRs and are presented in Appendix C.

Table 12. Summary of WET Test Data from 2007.

Toxicity Test	LOEC (%)	NOEC (%)	TUc
1st Quarter 2007			
Echinoderm (fertilization)	2.8	1.4	71.4
2nd Quarter 2007			
Echinoderm (fertilization)	> 2.8	≥ 2.8	≤ 35.7
3rd Quarter 2007			
Bivalve (survival)	2.8	1.4	71.4
Bivalve (development)	> 2.8	≥ 2.8	≤ 35.7
Topsmelt (survival)	> 2.8	≥ 2.8	≤ 35.7
Topsmelt (growth)	> 2.8	≥ 2.8	≤ 35.7
Echinoderm (fertilization)	1.4	0.7	142.9
4th Quarter 2007			
Echinoderm (fertilization)	> 2.8	≥ 2.8	≤ 35.7

First quarter 2007 echinoderm fertilization testing was performed on a single 24-hr composite sample collected on 29-30 January 2007. Results from this sample showed a significant decrease in egg fertilization at the 2.8 % sample concentration with an LOEC of 2.8 % and a NOEC of 1.4 % effluent. The TUc was 71.4, which was well within the permit maximum allowable limit of 143.

Sampling for the second quarter WET testing with echinoderms was performed on 15-16 April 2007. Results of the second quarter testing showed there was no significant reduction in

fertilization at any of the sample concentrations tested, with an LOEC of $> 2.8 \%$, an NOEC of $\geq 2.8 \%$, and a TUc of < 35.7 . All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicated typical sensitivity of the test populations for these tests.

The three-species WET testing was performed during the third quarter of 2007. The test included: the bivalve larvae, *Mytilus galloprovincialis*, survival and development; topsmelt, *Atherinops affinis*, survival and growth; and echinoderm, *Strongylocentrotus purpuratus* fertilization. The testing was performed on effluent samples collected from 30 July to 3 August 2007.

Results of the bivalve testing showed that the 2.8 % effluent concentration produced a significant increase in survival of the test organisms. The NOEC for survival was 1.4 % effluent and for development was $\geq 2.8 \%$ effluent and the LOECs were 2.8 % and $> 2.8 \%$, respectively. Chronic toxicity units were 71.4 TUc for survival and ≤ 35.7 TUc for development. Both reference toxicant tests were within laboratory control chart limits and indicated typical sensitivity of the test population.

Results of the topsmelt larval survival and growth testing performed showed no concentration of effluent tested produced significant mortality or significantly decreased growth of topsmelt larvae when compared to seawater-only controls. Concurrent reference toxicant testing for survival and growth exceeded laboratory control chart limits and indicate relative sensitivity of the test population. Also, all test acceptability criteria (TAC) were met in both effluent and reference toxicant bioassays.

Results of the echinoderm fertilization test conducted during the third quarter showed that significant decrease in egg fertilization occurred at the 2.8 % and 1.4 % effluent concentrations when compared to the seawater-only controls. The NOEC for fertilization was therefore 0.7 % and the LOEC was 1.4 %, with a TUc of 142.9, meeting the allowable permit limit of not exceeding 143. Results of these tests indicated that the echinoderm was the most sensitive of the three species tested for the Anchorage WPCF effluent.

The fourth quarter testing with echinoderms was performed on 22-23 October 2007. Results of the fourth quarter WET testing showed no significant decrease in egg fertilization at any sample concentration when compared with the seawater-only controls. The NOEC for fertilization was $\geq 2.8 \%$, the LOEC was $> 2.8 \%$ and the chronic toxicity units were ≤ 35.7 TUc. All test acceptability criteria were met in both the effluent bioassay and the reference toxicant bioassay.

3.1.5 Part 503 Sludge Monitoring Data

The AWWU operates a sludge incinerator at the Asplund WPCF for which the NPDES permit requires sludge monitoring twice per year as part of the "Toxic Pollutants and Pesticides/Pretreatment" sampling requirements. As described in Section 2.1.5, AWWU performed Part 503 sludge monitoring with a minimum frequency of once every 60 days. These data will be submitted along with other incinerator operational information to EPA by 19 February 2008. This submittal will take the form of a separate report; however, for completeness and for comparison purposes, this information has been included here as well.

Results of the sludge monitoring for metals for the year are presented in Table 13. Metals concentrations were extremely low compared to allowable limits and very similar to those seen historically. The only metal that had historically been elevated for some sampling events was arsenic. In 2007, the highest concentration of arsenic in the sludge was 7.85 mg/kg compared to the allowable limit of 95.8 mg/kg. As mentioned above, no actual limits exist in the current NPDES permit. Allowable limits are site-specific and were calculated by the permittee per Part 503 regulations. EPA plans to issue sludge only permits in the future; in the interim, 40 CFR Part 503 regulations are “self-implementing”.

3.2 RECEIVING WATER QUALITY MONITORING RESULTS

Water quality sampling of the receiving water was conducted on 19 - 20 June 2007, concurrent with the summer dry sampling. Sampling results are contained in the following subsections.

3.2.1 Plume Dispersion Sampling

Drogue Tracking Results

Drogues were released on 19 June 2007 at the ZID station for the ebb and flood tidal cycles and on 20 June 2007 at the control station for the flood tidal cycle. Three drogues were deployed during each tidal cycle.

ZID Site

The Point Woronzof ebb drogue drop and tracking cycles were performed during the morning of 19 June 2007. The tidal range during ebb stage was 27.5 feet (Figure 5 and Table 14; Micronautics, Inc. Tide 1: Rise and Fall®, 2007). A composite of the ebb drogue deployments is depicted in Figure 6.

The ebb drogues traveled from approximately 1.5 to 3.3 nautical miles, all three traveling in a southwesterly direction. No eddies were observed during these drogue tracks, nor did any of the drogues become grounded during their tracks. The first ebb (E1) drogue was released at 11:02 Alaska Daylight Time (ADT), about 19 minutes after high tide. This drogue tracked west-southwest and then more southerly between shore and south of the shoal that was evident at low tide. This drogue traveled at approximately 59 centimeters per second (cm/s) over its entire track of approximately 1.5 nautical miles. The second ebb drogue (E2) was released at 12:29 ADT and tracked well north of the shoal, traveling west southwest with an average speed of 101 cm/s over the entire track. The third drogue (E3) was released at 14:22 ADT just over 3 ½ hours after high slack. The third drogue followed a similar path to the E2 drogue traveling in a west southwesterly direction. This drogue traveled approximately 3.3 nautical miles at 101 cm/s over its entire track.

Flood drogue tracks are depicted in Figure 7. The tidal range during flood stage was 28.1 feet (Figure 5 and Table 14; Micronautics, Inc. Tide 1: Rise and Fall®, 2007). No eddies were observed during these drogue tracks, nor did any of the drogues become grounded during their tracks. The first flood drogue (F1) was deployed on 19 June at 17:50 ADT at low slack water at the outfall and tracked until 19:18 ADT. This drogue traveled easterly along the shoreline on the lee side of Point Woronzof for approximately 1.5 nautical miles before entering the shallow

Table 13. Part 503 Discharge Monitoring Data for Sludge Metals. Concentrations are in mg/kg dry weight. All metals are reported as total metals.

Parameter	Arsenic	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel
MDL	0.3	0.02	2/0.05 ^b	3/0.2 ^b	0.2	0.06	3/0.2 ^b
Permit Limit ^a	95.8	500 ^c	66.6	2,466	7,707	9.63 ^d	102,764
02/06/07 ^e	5.67	ND (<3.38)	0.986	15.5	18.3	0.576	9.43
04/23/07 ^e	ND (<3.20)	ND (<0.320)	1.52	15.8	22.9	0.590	12.3
06/19/07	3.69	ND (<1.66)	ND (<1.66)	13.3	9.76	1.03	10.0
08/07/07	3.93	ND (<1.37)	ND (<1.37)	13.7	18.9	1.04	11.0
10/16/07 ^e	7.85	ND (<0.307)	2.37	15.7	25.1	0.997	13.4
12/05/07 ^e	3.87	ND (<0.326)	1.38	12.8	18.7	0.674	10.0
MINIMUM	ND	ND	0.986	12.8	9.76	0.576	9.43
MAXIMUM	7.85	ND	2.37	15.8	25.1	1.04	13.4
AVERAGE	5.00	ND	1.56	14.5	18.9	0.818	11.0

MDL Method detection limit

^a Site Specific Allowable Limits calculated in *Air Operating Permit Application* submitted to ADEC.

^b Cadmium, chromium, and nickel were analyzed by furnace method EPA 7130, 7190 and 7520 respectively, on the Feb.-June samples.

^c Beryllium emissions shall not exceed 10 grams per day. With a control efficiency of 0.9998 at the maximum sludge feed rate, a sludge concentration of 500 milligrams per dry kilogram of sludge will not result in a violation of the limit.

^d Mercury emissions shall not exceed 3,200 grams per day. With a control efficiency of 0.0 at the maximum sludge feed rate, a sludge concentration of 9.63 milligrams per dry kilogram of sludge will not result in a violation of the limit.

^e The February, April, October, and December 2007 metals analysis were analyzed by SGS of Anchorage, AK by EPA 6020, Mercury by EPA 7471A methods. Parentheses contain PQL values.

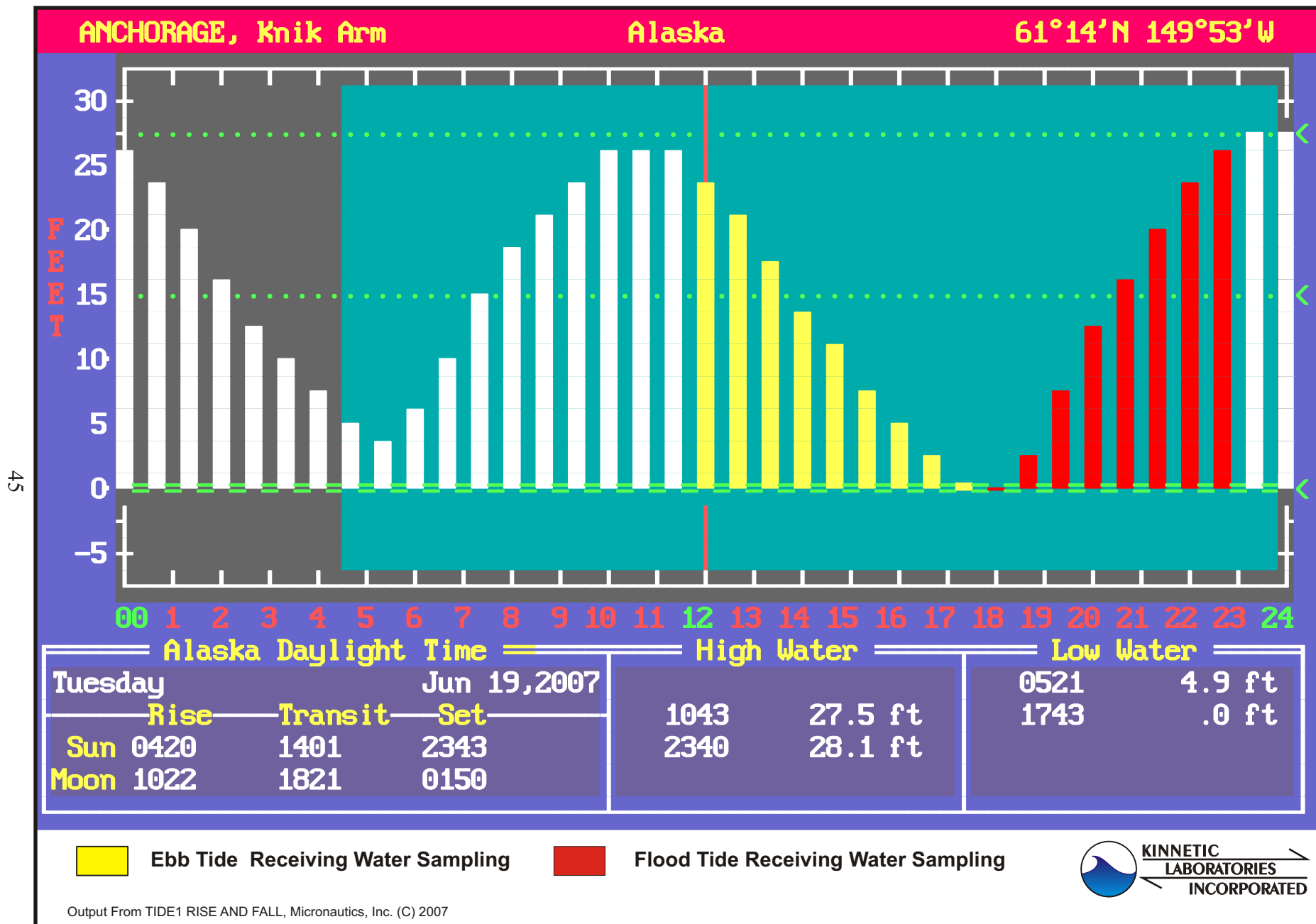


Figure 5. Tidal Information for Receiving Water Sampling, Ebb and Flood Tides.

Table 14. 2007 Drogue Tracking Information.

DATE	STATION	TIDAL INFORMATION				DROGUE NO.	RELEASE TIME AFTER SLACK (HOURS:MINUTES)	DROGUE SPEED (CM/S)
		Slack Water (Alaska Daylight Time ^a ; Stage)	Direction	Range (Feet) ^b				
19 June 2007	ZID	1043	HIGH	EBB	27.5	E1	00:19	59
19 June 2007	ZID	1043	HIGH	EBB	27.5	E2	01:46	101
19 June 2007	ZID	1043	HIGH	EBB	27.5	E3	03:39	101
19 June 2007	ZID	1743	LOW	FLOOD	28.1	F1	00:07	53
19 June 2007	ZID	1743	LOW	FLOOD	28.1	F2	01:46	81
19 June 2007	ZID	1743	LOW	FLOOD	28.1	F3	03:13	107
20 June 2007	CONTROL	1818	LOW	FLOOD	24.3	C1	00:00	71
20 June 2007	CONTROL	1818	LOW	FLOOD	24.3	C2	01:45	172
20 June 2007	CONTROL	1818	LOW	FLOOD	24.3	C3	03:02	219

^a Tide1: Rise and Fall®, Micronautics, Inc. 2007. (Knik Arm, Anchorage)

^b Predicted water level variations during tide.

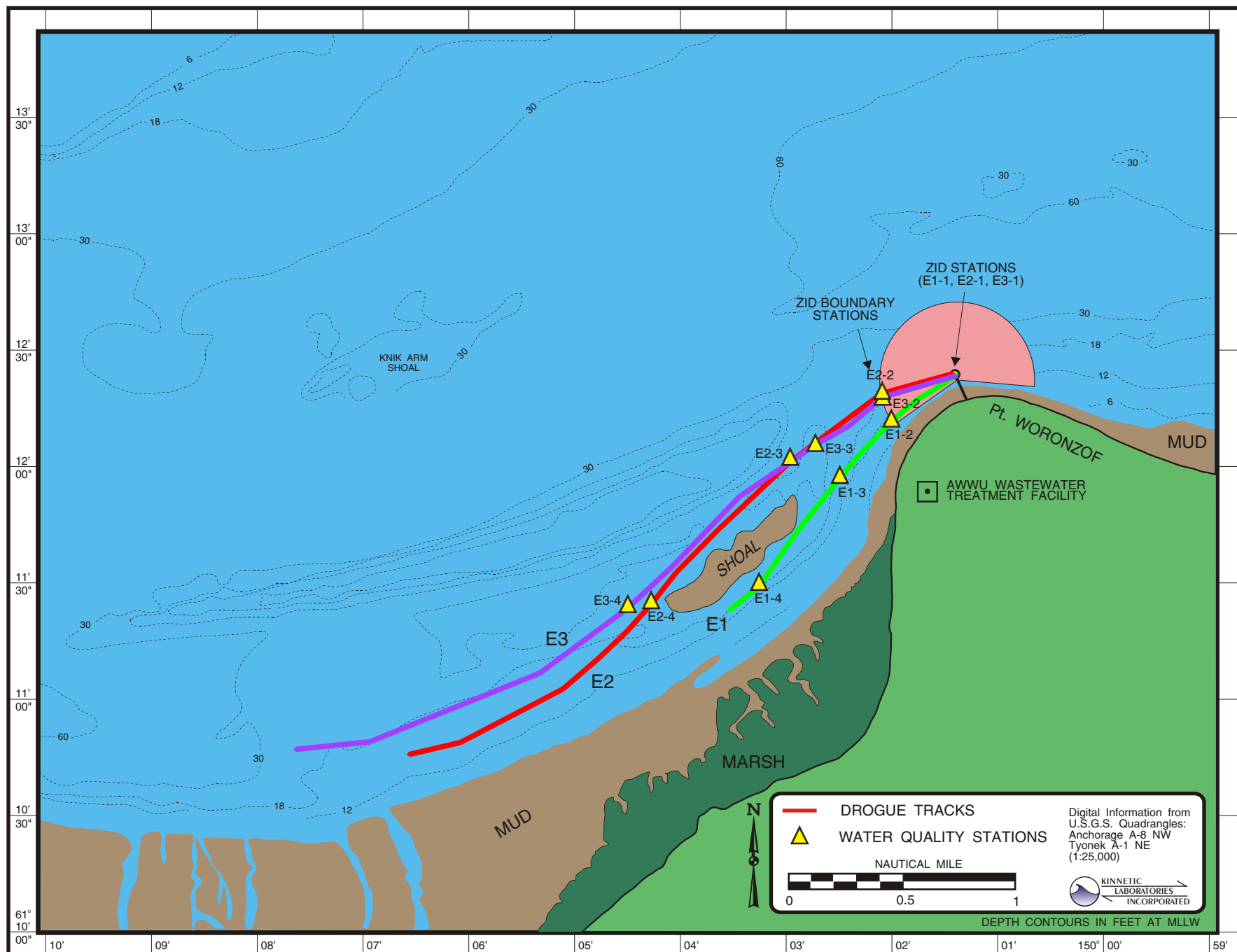


Figure 6. Summary of Ebb Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 19 June 2007.

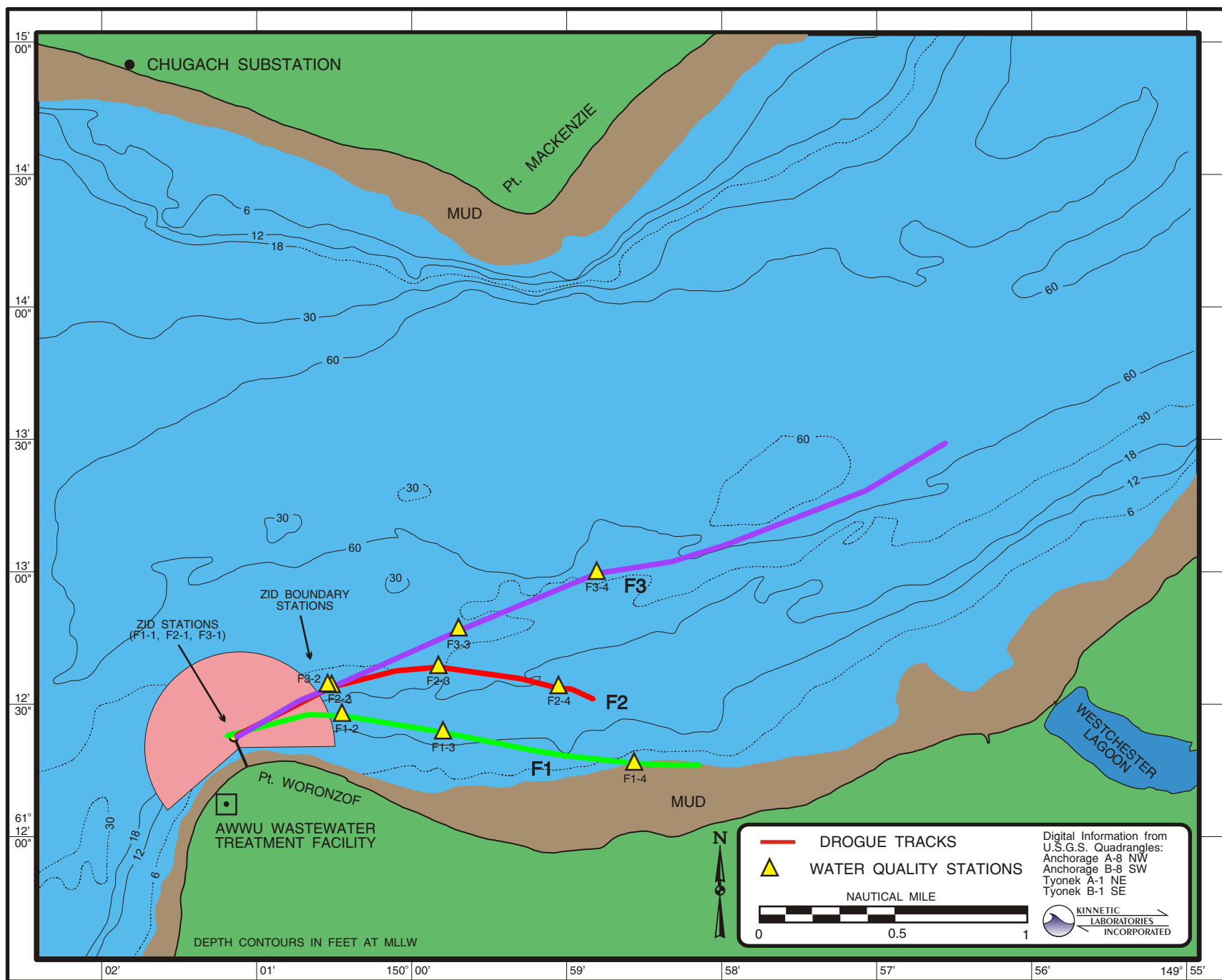


Figure 7. Summary of Flood Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 19 June 2007.

intertidal area where it was retrieved. The drogue traveled at an average speed of approximately 53 cm/s. The second flood drogue (F2) was deployed at 19:29 ADT, approximately 1 hour 35 minutes after low slack. This drogue was transported initially to the northeast then easterly and further offshore than the first drogue for about 1.5 nautical miles at an average speed of 81 cm/s before it was recovered at 20:15 ADT.

The third flood drogue (F3) was deployed at 20:56 ADT, just over 3 hours after low slack water, and tracked just 2 hours until recovery at 22:08 ADT. The third drogue traveled in a northeast direction as had the second drogue for more than a mile, then moved further out from the shoreline, where it continued moving northeast in the central Knik Arm Channel with an average speed of 107 cm/s. This drogue was tracked for approximately 3 nautical miles and was recovered offshore and to the west of Westchester Lagoon in mid-channel.

Control Site

The Point MacKenzie control drogues were deployed and tracked on 20 June 2007. The predicted tidal range during the flood tide was 24.3 ft. Tidal information is provided in Figure 8 and Table 14 (Micronautics, Inc. Tide 1: Rise and Fall[®], 2007). A composite of the three drogue trajectories is presented in Figure 9.

All three control drogues had similar tracks with the first drogue (C1) tracking closer to shore. The first drogue was released at 18:18 ADT, right at slack water, and traveled to the east and then to the northeast. After traveling approximately 2½ nautical miles, the drogue was picked up at 19:50 ADT. This drogue had an average speed of 71 cm/s over the entire track. The second drogue (C2) was released at 20:03 ADT, 1 hour and 45 minutes into the flood tidal cycle, and tracked until recovery at 21:03 ADT. This drogue had an average speed of 172 cm/s over the entire track and moved towards the northeast offshore of the first drogue, more in mid-channel and more northerly after passing Cairn Point traveling just under 4 nautical miles. The third control drogue (C3) was released at 21:20 ADT, just over 3 hours after high slack water. The drogue traveled in a manner similar to the second drogue and slightly further offshore, moving northeast into the central channel with an average speed of 219 cm/s. Abreast of Cairn Point, the drogue turned more toward the north for the last part of its trajectory, traveling over 4½ nautical miles in all.

Summary of Water Quality Data

The summer water quality sampling for all analysis types was conducted concurrently with the drogue tracking studies on 19 - 20 June 2007. As discussed previously, three drogues were released at the ZID for both ebb and flood tides and three were released at the control site for the flood tide. Water samples and CTD measurements were obtained at four stations along each drogue's track prior to their being retrieved. In the current NPDES permit, the ZID boundary is located 650 m distance from the outfall diffuser. To accomplish the ZID site sampling, the vessel was positioned directly upcurrent from the diffuser and allowed to drift down across it. Upon reaching the outfall diffuser, the drogue was dropped and the within-ZID station sampled. The distance from the outfall diffuser was monitored with the DGPS, and upon reaching 650 m distance from the diffuser, the ZID-boundary station was sampled. The third and fourth stations were then sampled along the drogue's path. Due to high current speeds, anchoring the vessel and sampling at each station was not practical or desirable for this type of sampling.

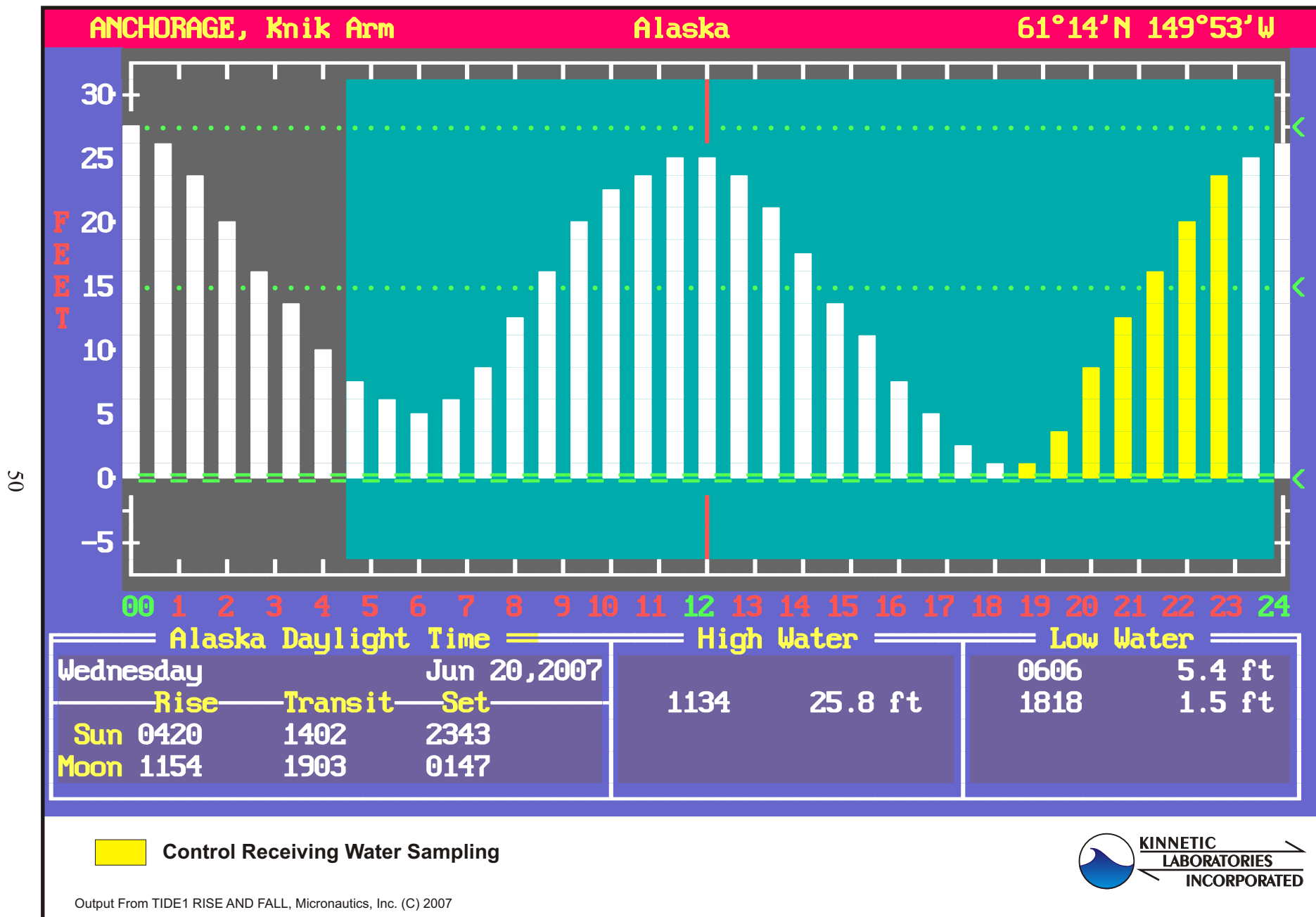


Figure 8. Tidal Information for Receiving Water Sampling, Control Tide.

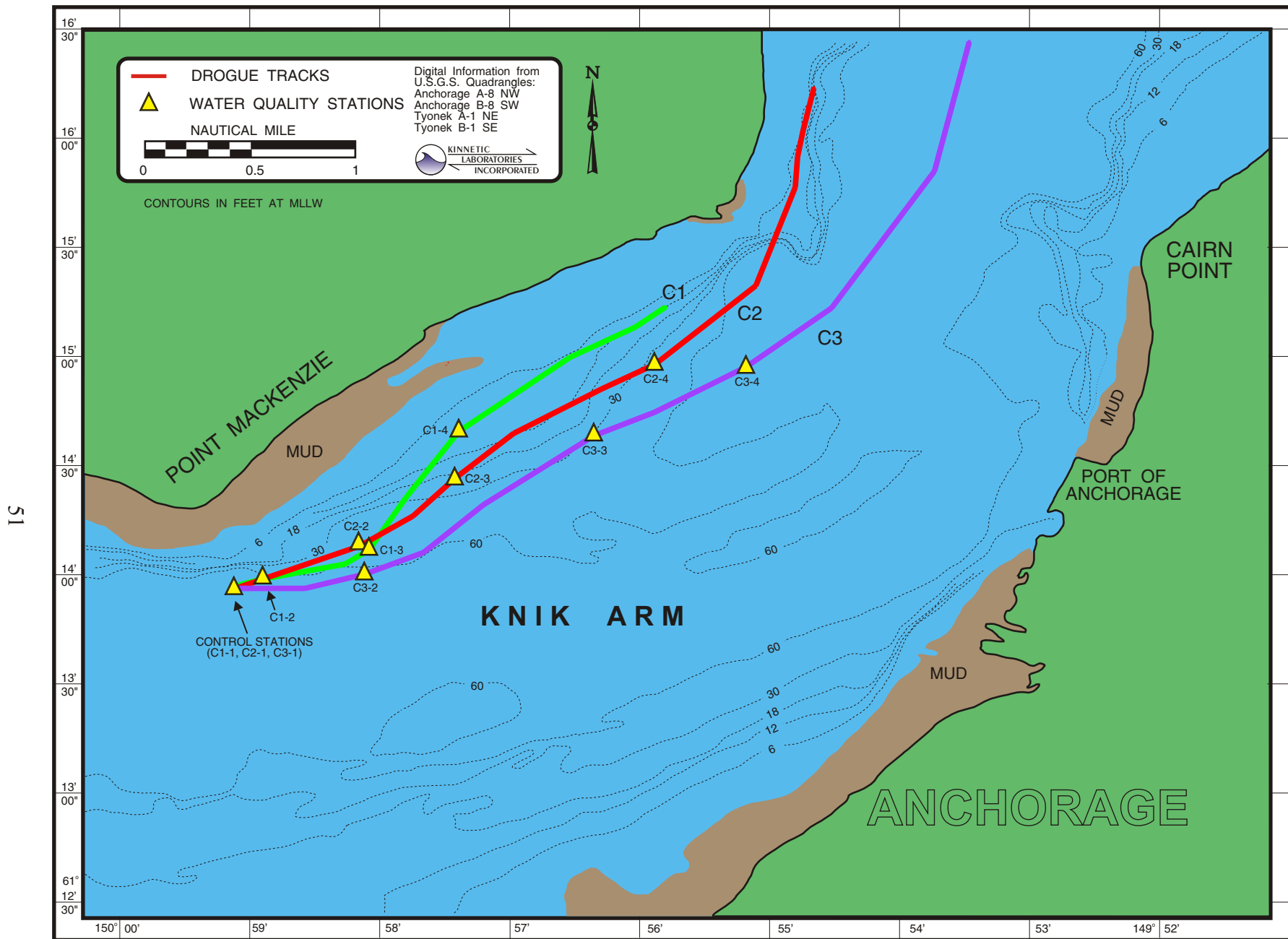


Figure 9. Summary of Control Drogue Tracks and Receiving Water Sampling Locations at Point MacKenzie, 20 June 2007.

Table 15 provides a summary of the water quality measurements obtained, where the station designation is represented by: drogue drop location (C=control, E=ebb, and F=flood), the first number represents the drogue number, and the second number represents the station along the drogue's path. The final character represents surface (S), mid-depth (M), or bottom (B) sample.

The waters of the inlet are extremely well-mixed both vertically and horizontally, as indicated by the CTD data. During the survey, temperatures ranged from a minimum of 11.87 °C to a maximum of 13.82 °C. Salinities were found to vary from a minimum of 13.05 parts per thousand practical salinity units (psu) to a maximum of 17.22 psu. Salinities were generally found to increase slightly during the flood and decrease on the ebb, as is typical for estuaries. As has been seen often times in the past, the control stations were found to be slightly warmer and less saline due to a greater influence from river runoff. Values for pH ranged from 7.94 to 8.15 with little to no vertical stratification. Values for DO collected in-situ by the CTD ranged from 9.36 to 9.56 mg/L with most concentrations being at 100 percent saturation.

Representative hydrographic profiles of water quality are presented for a ZID boundary station during flood tide, Station E2-2, and a typical station from the second control drogue drop, Station C2-2 (Figure 10). The water column was found to be well-mixed from the surface to the bottom at all stations. Refer to Appendix D9 for hydrographic profile plots and data from each water quality station.

Surface samples were obtained at each station for the analysis of color, TRC, fecal coliform bacteria, and turbidity. Color values ranged from 5 to 40 color units on the platinum-cobalt scale. These are the highest color values ever observed over the 20-year history of the program and are believed to be the result of insufficient removal of suspended sediment and/or new equipment used by the laboratory as high levels were seen at both the outfall and control sites and are not the result of AWWU's discharge.

With the exception of three stations located near the ZID, F1-1, F2-2, and F2-3, all TRC concentrations were at or below the MDL of 0.010 mg/L. TRC concentrations were 0.052 mg/L at Station F1-1, 0.018 mg/L at F2-2, and 0.012 mg/L at F2-3. It should be noted that the lowest MDL achievable in seawater for TRC analysis is higher than the State-specified limit of 0.002 mg/L (for salmonid fish) and at the limit of 0.01 mg/L for other marine species. The amperometric method that was used for the receiving water sampling is the preferred method since it is affected little by common oxidizing agents, temperature, turbidity, or color, but all TRC methods are subject to positive interferences in estuarine or marine waters. The average TRC concentrations of the effluent, collected every three hours for the sampling dates 19 and 20 June 2007 were 0.41 and 0.59 mg/L, respectively.

Fecal coliform values this year were quite low and ranged from < 2 to 4 FC MPN/100 mL. More than half of the fecal coliform concentrations were reported at < 2; this included 21 out of 24 samples at the ebb and flood stations combined and 15 out of 16 samples at the control stations. The overall median for fecal coliform samples at all outfall stations (both ebb and flood) was < 2.0 FC MPN/100 mL; the median at the control stations was < 2.0 FC MPN/100 mL.

Turbidity values for water samples collected during the monitoring ranged from a low of 27 Nephelometric Turbidity Units (NTU) to a high of 545 NTU.

Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2007.

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp ^b (°C)	Salinity ^b (‰)	pH ^b (units)	D.O. ^b (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform ^a
JUNE 19												
E1-1S	1102	61° 12.344'	150° 01.270'	0.5	12.38	15.86	7.97	9.47	458	5 / 5	<0.010	<2
-1M				6.0	12.14	16.43	7.98	9.52	462			
-1B				11.5	12.11	16.62	7.99	9.51	338			
E1-2S	1123	61° 12.146'	150° 01.894'	0.5	12.38	16.07	7.97	9.54	46/86	25	<0.010	<2
-2M				6.0	12.11	16.88	7.99	9.55	234			
-2B				12.0	11.91	17.14	7.99	9.52	290			
E1-3S	1138	61° 11.906'	150° 02.379'	0.5	12.23	16.42	7.99	9.52	114/115	10	<0.010	<2
-3M				3.0	11.90	17.12	8.00	9.53	160			
-3B				6.0	11.87	17.18	8.00	9.53	386			
E1-4S	1204	61° 11.446'	150° 03.140'	0.5	12.02	17.01	8.00	9.56	292	30	<0.010	<2
-4M				2.5	11.96	17.14	8.00	9.55	300			
-4B				5.0	11.94	17.22	8.00	9.56	332			
E2-1S	1229	61° 12.351'	150° 01.313'	0.5	12.43	16.17	7.98	9.51	205/214	15	<0.010	<2
-1M				5.0	12.15	16.48	7.98	9.53	388			
-1B				9.5	12.12	16.55	7.99	9.50	424			
E2-2S	1234	61° 12.266'	150° 01.987'	0.5	12.21	16.49	7.99	9.49	377	40	<0.010	<2
-2M				6.5	12.19	16.46	7.99	9.52	411			
-2B				12.0	12.08	16.66	7.99	9.53	413			
E2-3S	1244	61° 11.977'	150° 02.847'	0.5	12.15	16.58	7.99	9.49	381	10	<0.010/<0.010	<2
-3M				5.0	12.13	16.59	7.99	9.53	387/407			
-3B				10.0	12.12	16.60	8.00	9.47	417			

Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2007. (continued)

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp ^b (°C)	Salinity ^b (‰)	pH ^b (units)	D.O. ^b (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform ^a
E2-4S	1308	61° 11.372'	150° 04.158'	0.5	12.15	16.63	7.99	9.53	382	5	<0.010	<2
-4M				5.0	12.15	16.63	7.99	9.52	388			
-4B				9.5	12.14	16.64	7.99	9.51	395			
E3-1S	1422	61° 12.340'	150° 01.280'	0.5	12.55	15.37	7.94	9.50	413	10	<0.010	<2
-1M				3.5	12.56	15.50	7.96	9.50	422			
-1B				6.5	12.56	15.46	7.96	9.46	431			
E3-2S	1430	61° 12.249'	150° 01.978'	0.5	12.59	15.65	7.98	9.49	378	10	<0.010	<2
-2M				5.0	12.57	15.65	7.98	9.51	436			
-2B				10.0	12.57	15.66	7.98	9.49	427/433			
E3-3S	1442	61° 12.048'	150° 02.608'	0.5	12.60	15.69	7.98	9.47	420	25 / 25	<0.010	<2
-3M				3.5	12.56	15.72	7.99	9.49	434			
-3B				6.5	12.55	15.76	7.99	9.48	441			
E3-4S	1522	61° 11.356'	150° 04.380'	0.5	12.69	15.83	7.99	9.49	368	10	<0.010	<2
-4M				4.5	12.39	16.20	7.99	9.51	415			
-4B				8.5	12.28	16.44	8.00	9.55	334/357			
F1-1S	1740	61° 12.346'	150° 01.347'	0.5	13.19	14.89	7.95	9.47	229	25	0.052	<2
-1M				1.0	13.20	15.09	7.98	9.45	238			
-1B				1.5	13.20	15.17	7.98	9.47	254			
F1-2S	1821	61° 12.421'	150° 00.588'	0.5	13.26	14.92	7.98	9.48	218	10	0.010	<2
-2M				1.5	13.26	14.91	7.98	9.46	243			
-2B				2.5	13.26	14.92	7.98	9.47	248			
F1-3S	1834	61° 12.360'	149° 59.948'	0.5	13.30	14.95	7.99	9.47	208	5	<0.010	4
-3M				2.0	13.29	14.94	7.99	9.48	243			
-3B				3.5	13.28	14.94	7.99	9.47	250			

Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2007. (continued)

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp ^b (°C)	Salinity ^b (‰)	pH ^b (units)	D.O. ^b (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform ^a
F1-4S	1854	61° 12.270'	149° 59.143'	0.5	13.28	14.86	7.99	9.47	263/267	10	<0.010	<2
-4M				1.5	13.28	14.86	7.99	9.47	252			
-4B				3.0	13.28	14.86	7.99	9.45	255			
F2-1S	1929	61° 12.344'	150° 01.284'	0.5	13.07	15.65	7.96	9.43	468	25	<0.010	<2
-1M				2.5	13.07	15.68	7.96	9.41	465			
-1B				5.0	13.07	15.72	7.97	9.41	488			
F2-2S	1936	61° 12.528'	150° 00.672'	0.5	13.11	15.84	7.97	9.42	474	15	0.018	<2
-2M				4.5	13.10	15.79	7.98	9.44	486			
-2B				8.5	13.11	15.79	7.99	9.46	515			
F2-3S	1946	61° 12.605'	149° 59.975'	0.5	13.12	15.75	7.98	9.46	242	10	0.012	<2
-3M				5.5	13.11	15.67	7.99	9.46	511/492			
-3B				11.0	13.13	15.75	7.99	9.47	536			
F2-4S	2003	61° 12.523'	149° 59.194'	0.5	13.16	15.71	7.98	9.47	232	15	<0.010/<0.010	<2
-4M				4.0	13.12	15.66	7.99	9.45	505			
-4B				7.5	13.13	15.64	7.99	9.47	512			
F3-1S	2056	61° 12.339'	150° 01.282'	0.5	12.88	15.62	7.97	9.48	338	10 / 10	<0.010	2
-1M				4.0	12.88	15.56	7.96	9.48	356			
-1B				8.0	12.88	15.58	7.96	9.46	351			
F3-2S	2103	61° 12.528'	150° 00.664'	0.5	12.89	15.70	7.98	9.49	319	20	<0.010	<2
-2M				5.5	12.89	15.68	7.99	9.50	334			
-2B				11.0	12.90	15.62	7.99	9.50	359/362			
F3-3S	2114	61° 12.741'	149° 59.843'	0.5	12.90	15.63	7.98	9.49	288	10	0.010	2
-3M				8.0	12.72	16.03	7.99	9.48	390			
-3B				16.0	12.73	16.02	7.99	9.46	395			

Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2007. (continued)

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp ^b (°C)	Salinity ^b (‰)	pH ^b (units)	D.O. ^b (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform ^a
F3-4S	2128	61° 12.957'	149° 58.950'	0.5	12.87	15.67	7.97	9.50	142	10	<0.010	<2
-4M				8.5	12.71	15.98	7.98	9.51	370			
-4B				17.0	12.66	16.04	7.99	9.49	396			
JUNE 20												
C1-1S	1818	61° 13.952'	149° 59.100'	0.5	13.58	13.88	8.15	9.50	125	25	<0.010	<2
-1M				11.0	13.40	13.88	8.11	9.51	451			
-1B				22.0	13.26	14.26	8.15	9.48	452			
C1-2S	1845	61° 13.977'	149° 59.905'	0.5	13.64	13.91	8.03	9.51	218	15	<0.010	<2
-2M				11.0	13.40	13.92	8.05	9.52	416			
-2B				22.0	13.17	14.22	8.08	9.48	545			
C1-3S	1905	61° 14.119'	149° 58.080'	0.5	13.73	13.05	8.00	9.54	161	20	<0.010	<2
-3M				7.5	13.80	13.22	8.03	9.50	192			
-3B				15.0	13.33	14.04	8.04	9.47	416			
C1-4S	1925	61° 14.662'	149° 57.387'	0.5	13.75	13.61	8.01	9.49	323/323	40	<0.010	<2
-4M				2.5	13.78	13.60	8.01	9.49	308			
-4B				4.5	13.82	13.62	8.02	9.46	299			
C2-1S	2003	61° 13.948'	149° 59.085'	0.5	13.58	13.58	7.97	9.50	27	10	<0.010	<2
-1M				12.0	13.34	14.02	7.98	9.50	330			
-1B				23.5	13.37	14.54	8.00	9.46	293			
C2-2S(A)	2010	61° 14.137'	149° 58.148'	0.5	13.45	13.65	7.98	9.51	263	25	<0.010	<2
-2S(B)	2010			0.5	13.44	13.67	7.98	9.50	265	15 / 15	<0.010	<2
-2S(C)	2010			0.5	13.47	13.62	7.98	9.49	264	20	<0.010	2
-2M				7.5	13.40	13.72	7.99	9.50	312			
-2B				15.0	13.36	13.85	8.03	9.45	420/418			

Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2007. (continued)

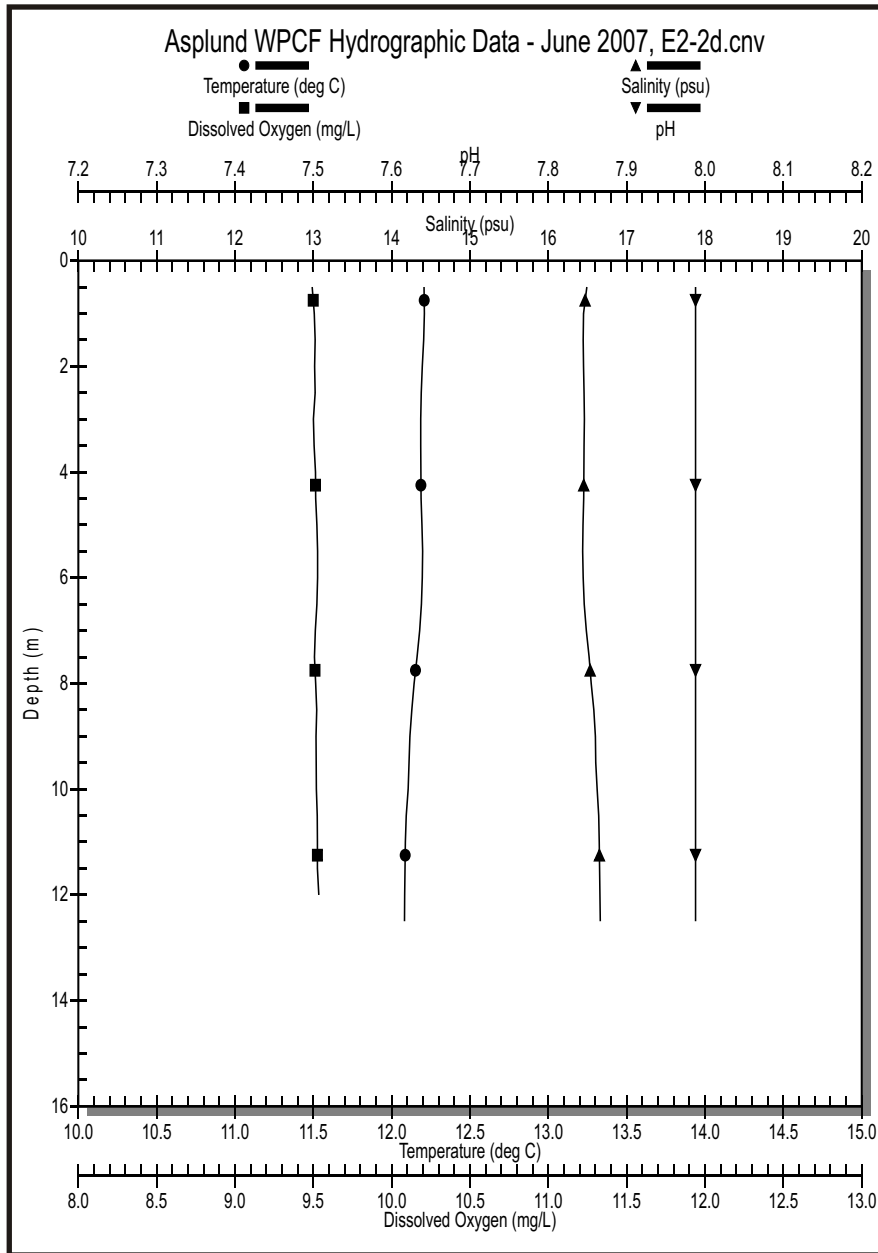
Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp ^b (°C)	Salinity ^b (‰)	pH ^b (units)	D.O. ^b (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform ^a
C2-3S	2017	61° 14.447'	149° 57.415'	0.5	13.41	13.80	8.00	9.47	243	20	<0.010	<2
-3M				3.5	13.38	13.86	8.00	9.47	290			
-3B				7.0	13.35	13.88	8.01	9.43	403			
C2-4S	2030	61° 14.970'	149° 55.875'	0.5	13.48	13.73	7.97	9.49	217	20	<0.010	<2
-4M				9.5	13.37	13.85	7.98	9.50	326			
-4B				18.5	13.36	13.94	8.01	9.47	342			
C3-1S(A)	2120	61° 13.945'	149° 59.101'	0.5	13.29	15.27	7.97	9.46	271	20	<0.010	<2
-1S(B)	2120			---	---	---	---	---	270	20		<2
-1S(C)	2120			---	---	---	---	---	278	20		<2
-1M				13.5	12.97	15.35	7.96	9.48	452/444			
-1B				26.5	12.94	15.33	7.99	9.45	454			
C3-2S	2128	61° 14.008'	149° 58.109'	0.5	13.26	15.36	7.96	9.43	247	25	<0.010	<2
-2M				11.0	13.01	15.46	7.97	9.43	403			
-2B				21.5	12.95	15.29	8.00	9.36	415			
C3-3S	2141	61° 14.643'	149° 56.346'	0.5	13.27	15.40	7.97	9.43	270	30	<0.010	<2
-3M				8.0	13.16	15.38	7.98	9.45	382			
-3B				15.5	12.99	15.18	8.00	9.48	507			
C3-4S	2151	61° 14.956'	149° 55.184'	0.5	13.32	15.21	7.95	9.45	280	35	<0.010	<2
-4M				19.5	13.29	15.29	7.96	9.47	265			
-4B				39.0	12.98	15.30	7.97	9.47	487			

^a Fecal coliform reported as MPN/100 mL.

^b Values from CTD for 0.5 m depth taken as close to surface as possible.

--- Samples not collected.

Outfall Station



Control Station

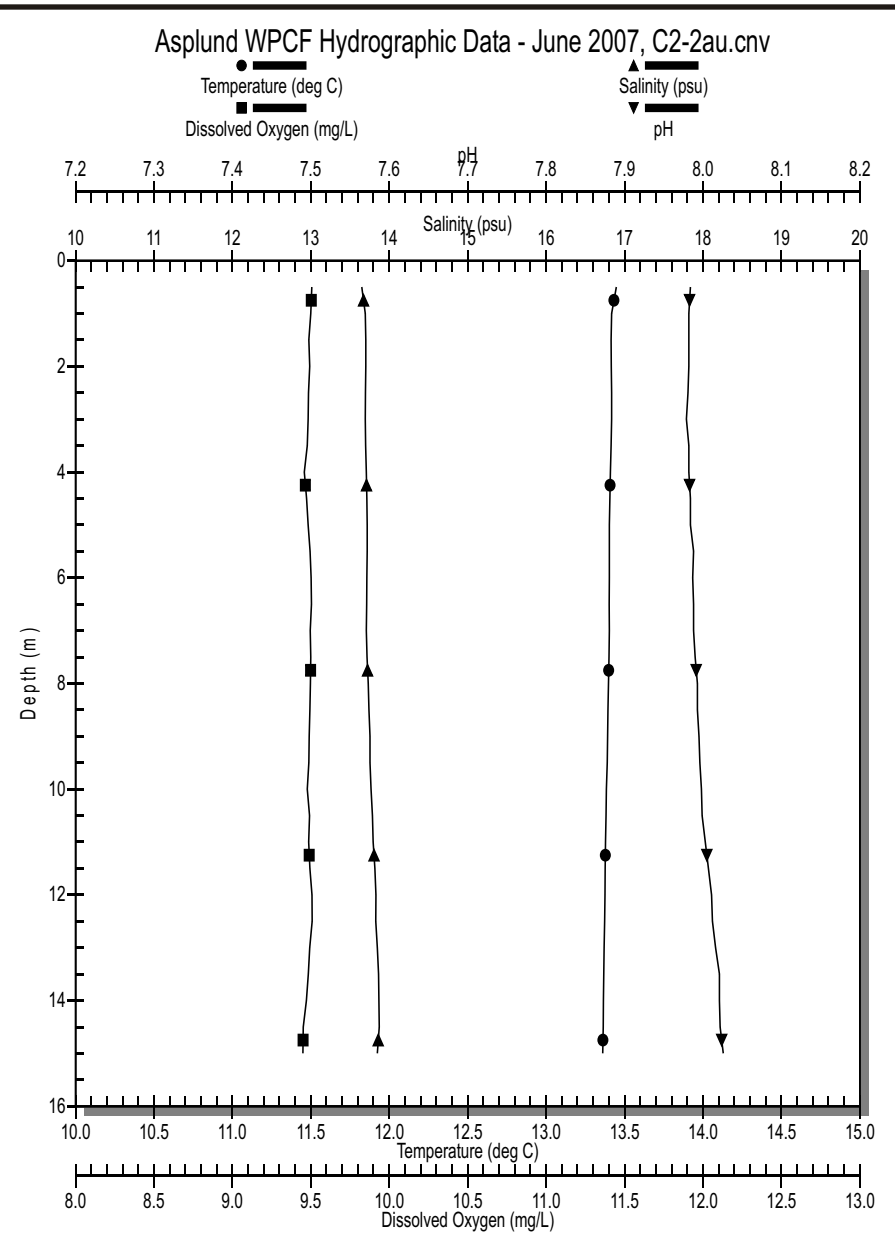


Figure 10. Sample Hydrographic Profiles from Outfall and Control Stations, June 2007.

In addition to routine monitoring conducted at each water quality station, supplemental surface samples were collected from the first three stations along the first drogue trajectory for the ZID and control floods. A sample of final effluent was also obtained at the same time for comparison. Supplemental samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), dissolved and total recoverable trace metals, cyanide, and TSS.

The maximum dissolved arsenic, cadmium, chromium, copper, nickel, and zinc concentrations were seen at Station F1-1 located at low slack water above the diffuser, within the ZID (Table 16). The highest dissolved lead concentration was seen at Station C1-2, while the highest dissolved mercury and silver concentrations were seen at the control station, C1-3. All dissolved metals concentrations met water quality criteria as they were considerably less than the State of Alaska SSWQC for the Point Woronzof area.

Total metals concentrations were also quite variable and other than slightly elevated levels at Station F1-1, differences between the outfall and control sites did not appear to exist that could be attributed to the discharge but were the result of differences in TSS concentrations. Station F1-1 was found to have the highest concentrations for five of the metals as tested by total recoverable methodology. Total suspended solid results ranged from 100 to 430 mg/L at the control stations compared to 280 to 300 mg/L at the outfall stations. The effluent sample had a TSS concentration of 57 mg/L.

Cyanide concentrations were found above the method detection limit of 2 µg/L at all receiving water stations including the control site stations. While the AWQS of 1 µg/L was not met for cyanide during the receiving water sampling. It is believed that the high concentrations are the result of seawater interference during analysis. The laboratory utilized SM4500E which is a direct colorimetric method that has been shown to be inaccurate for the analysis of cyanide in seawater. This inaccuracy is believed to be due to the high ionic strength of seawater, a known interference (Dzombak 2005). Discussions with the laboratory indicated that they did not adjust their procedures to account for the seawater salts in the sample. The cyanide concentration in the effluent sample collected in conjunction with the receiving water sampling was 9.0 µg/L which is well below the MAEC of 181 µg/L.

Hydrocarbon analyses results are presented in Table 17. Total aromatic hydrocarbons (TAH) as BETX (EPA Method 602 samples from the concurrent summer dry sampling) was determined by summing benzene, ethylbenzene, toluene, and total xylenes. For values reported as ND, the reporting limit was used in the summation. Total aromatic hydrocarbons at the water quality stations were all ND, or less than 2.0 µg/L with the exception of station F1-1 which had a concentration of 2.5 µg/L. Concentrations of TAH were below the receiving water standard of 10 µg/L at all stations, including both outfall and control stations. The effluent sample had a TAH concentration of 8.5 µg/L, significantly less than in 2006 and significantly less than the MAEC of 1,810 µg/L.

All concentrations of individual PAHs were summed and reported as total PAHs (TPAH) in Table 17. The TPAH values ranged from 0.031 to 0.144 µg/L at the control stations and from 0.054 to 0.602 µg/L at the outfall stations. The highest TPAH was seen at Station F1-1. The TPAH concentration in the effluent sample was 4.84 µg/L. Total aqueous hydrocarbons (TAqH) as determined by the summation PAHs plus BETX were calculated for the six stations and effluent, with the contribution from BETX assumed to be 2 µg/L for those stations with all NDs (the sum of the individual detection limits for each ND compound; Table 17). Concentrations of

Table 16. Concentrations of Dissolved Metals, Total Recoverable Metals, Cyanide, and Total Suspended Solids in Receiving Water and Effluent Samples. Values have not been blank corrected.

Station	Arsenic	Cadmium	Cyanide	Chromium	Copper	Mercury	Nickel	Lead	Silver	Zinc	TSS
	µg/L					ng/L	µg/L				mg/L
Dissolved Metals											
F1-1S (WITHIN ZID) ^a	1.74/ 1.66	0.103/ 0.0988	NA	0.147/ 0.141	4.94/ 4.79	0.584/ 0.591	1.33/ 1.32	0.0216/ 0.0206	0.004 U/ 0.005 U	4.08/ 4.02	NA
F1-2S (ZID BOUNDARY)	1.53	0.0916	NA	0.137 U	1.45	0.484	1.25	0.00358	0.004 U	0.676	NA
F1-3S (NEAR FIELD)	1.50	0.0903	NA	0.137 U	1.10	0.641	1.18	0.003 U	0.004 U	0.468	NA
C1-1S (CONTROL)	1.41	0.0879	NA	0.137 U	1.16	0.660	1.32	0.00465	0.004 U	1.62	NA
C1-2S (CONTROL)	1.34	0.0920	NA	0.140	1.16	0.674	1.32	0.0822	0.00623	1.10	NA
C1-3S (CONTROL)	1.32	0.0861	NA	0.137 U	1.14	0.675	1.29	0.00393	0.00923	1.43	NA
EFFLUENT	1.19	0.0621	NA	3.20	7.93	4.18	2.82	0.251	0.0600 b	32.5	NA
DETECTION LIMIT	0.021	0.004	NA	0.137	0.048	0.19	0.054	0.003	0.004	0.112	NA
Total Metals											
F1-1S (WITHIN ZID)	6.58	0.138	9.00	10.1	17.4	31.9	11.1	3.84	0.248	40.7	300
F1-2S (ZID BOUNDARY)	6.65	0.126	11.0	9.89	14.4	24.0	10.6	3.79	0.0173	33.8	280
F1-3S (NEAR FIELD)	6.90	0.122	10.0	11.0	14.4	22.8	11.0	3.93	0.0101	35.8	290
C1-1S (CONTROL)	4.80	0.112	7.0	7.14	9.82	14.6	7.86	2.40	0.00953	23.9	100
C1-2S (CONTROL) ^b	5.22	0.118	8.0 / 13.0	7.96	11.1	15.2	8.49	2.75	0.0164	27.0	140 / 140
C1-3S (CONTROL)	7.62	0.124	10.0	10.9	15.4	25.6	11.2	4.33	0.0116	37.8	430
EFFLUENT ^a	1.34	0.229	9J/9J/10	3.69	35.1	52.1	3.58	1.99	1.74	71.8	57
DETECTION LIMIT	0.021	0.004	2.0	0.137	0.048	0.19	0.054	0.003	0.004	0.112	4.0

^a Field sample value/lab duplicate value (where applicable)

^b Field sample value/field duplicate value (where applicable)

b Blank concentration is greater than 10X the MDL and sample concentration is less than 5x the blank concentration, result should be considered an estimate.

NA Not applicable J Estimated value

U Not detected at or above the detection limit.

Table 17. Supplemental Receiving Water and Effluent Hydrocarbon Analyses.

PARAMETER	CONTROL FLOOD SAMPLES			ZID FLOOD SAMPLES			EFFLUENT
	C1-1S	C1-2S	C1-3S	F1-1S	F1-2S ^a	F1-3S	
Volatile Organics (EPA 602) in µg/L with reporting limit in parenthesis if ND							
Benzene	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(0.5)/ND(0.5)	ND (0.5)	ND (0.5)
Toluene	ND (0.5)	ND (0.5)	ND (0.5)	0.96	0.40 J/ 0.61J	ND (0.5)	4.9
Ethylbenzene	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(0.5)/ND(0.5)	ND (0.5)	ND (0.5)
Xylenes (Total)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(0.5)/0.34 J	ND (0.5)	2.6
TAH (as BETX)	ND	ND	ND	2.5	1.9 J/ 2.0 J	ND	8.5
Polynuclear Aromatic Hydrocarbons (PAH) by GC/MS in µg/L							
TPAH	0.144	0.031	0.036	0.602	0.059	0.054	4.835
Total Aqueous Hydrocarbons (TAqH) in µg/L							
TAqH ^b	2.14	2.03	2.04	3.10	1.96/ 2.06	2.05	13.34

^a Duplicate field sample analysis provided (value/duplicate value)

^b Defined by the State of Alaska as BETX analytes plus PAH analytes from EPA Method 610 analysis; these calculated values include the full suite of PAH analyte values measured by from GERG not analyte values from EPA method 610

ND None detected

J Estimated value. Result is less than reporting limits.

TAqH were below the receiving water standard of 15 µg/L at all stations, including both outfall and control stations. Control stations ranged in TAqH from 2.03 to 2.14 µg/L, while outfall station TAqH concentrations ranged from 1.96 to 3.10 µg/L. The concentration of TAqH in the effluent was estimated at 13.34 µg/L, compared to the MAEC of 2,715 µg/L.

3.2.2 Intertidal Zone and Stream Bacterial Sampling

Intertidal zone and stream bacteriological sampling was performed on 19 June 2007 (Table 18). Refer to Figure 3 for a map of the station locations. Intertidal sampling began approximately 1 hour prior to high tide at 21:26 ADT and was completed at 22:05 ADT. Two replicates were taken at all intertidal stations. Stream sampling was conducted from 18:10 to 18:50 ADT on 19 June 2007. In addition, an effluent sample was collected at the plant at 16:00 ADT on this date.

Fecal coliform concentrations in the intertidal were very low this year and ranged from <2.0 to 2 FC MPN/100 mL. The highest fecal concentrations (2 FC MPN/100 mL) were seen at the second replicate at Station IT-2, 1200 m east of the diffuser, and the second replicate at Station IT-3, 750 m east of the diffuser. Fecal coliform concentrations found in Fish, Chester, and Ship Creeks were lower than those seen in 2006, ranging from 2 FC MPN/100 mL in the first replicate at Chester Creek to 26 FC MPN/100 in the first replicate collected from Fish Creek. The replicate plant effluent samples taken on the same day showed fecal concentrations of 12 and 40 FC MPN/100 mL.

Table 18. Summary of Bacterial Analyses, 19 June 2007.

Station and Replicate	Sample Time (ADT)	Fecal Coliform MPN/100 mL
IT-1 Replicate 1	2205	<2
IT-1 Replicate 2	2205	<2
IT-2 Replicate 1	2200	<2
IT-2 Replicate 2	2200	2
IT-3 Replicate 1	2157	<2
IT-3 Replicate 2	2157	2
IT-4 Replicate 1	2154	<2
IT-4 Replicate 2	2154	<2
IT-5 Replicate 1	2149	NT
IT-5 Replicate 2	2149	<2
IT-6 Replicate 1	2145	<2
IT-6 Replicate 2	2145	<2
IT-7 Replicate 1	2141	<2
IT-7 Replicate 2	2141	<2
IT-C Replicate 1	2126	<2
IT-C Replicate 2	2126	<2
Plant Effluent Rep. 1	1600	12
Plant Effluent Rep. 2	1600	40
Fish Creek Rep. 1	1810	26
Fish Creek Rep. 2	1810	11
Chester Creek Rep.1	1825	2
Chester Creek Rep.2	1825	4
Ship Creek Rep. 1	1850	13
Ship Creek Rep. 2	1850	4

NT Not tested; sample received broken at lab.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

4.1 OBJECTIVES

The program includes a comprehensive quality assurance/quality control (QA/QC) program that encompasses all aspects of the project, from initial sample collection and field observation recording through laboratory analysis and data analysis to reporting. The objectives of the QA/QC program were to fully document the field and laboratory data collected, to maintain and document data quality, and to ensure that the data collected are of sufficient quality to be comparable with data collected through other EPA-regulated NPDES programs. The program was designed to allow the data to be assessed by the following parameters:

- Precision
- Accuracy
- Comparability
- Representativeness
- Completeness.

These parameters were controlled by adhering to documented methods and procedures, by the analysis of quality control (QC) samples on a routine basis, through the use of laboratories with existing QA/QC plans, through data review and verification procedures, and through a comprehensive sample documentation program. Throughout the program, KLI coordinated with the subcontracting laboratories to ensure that their in-house QA/QC programs were being implemented to meet the required standards.

Quality control activities in the field included adherence to documented procedures, including those in the program workplan, and the comprehensive documentation of sample collection and sample identification information. Sample integrity and identification were ensured by a rigidly-enforced chain of custody program. The chain of custody procedure documents the handling of each sample from the time the sample was collected to the arrival of the sample at the laboratory.

Analytical methods in use on the program have been approved and documented by EPA. These methods were used as project-specific protocols to document and guide analytical procedures. Adherence to these documented procedures ensures that analytical results are properly obtained and reported.

4.2 FIELD QUALITY CONTROL

Quality control activities in the field consisted of the following:

- adherence to documented procedures in the workplan
- cross-checking of field identifications, measurements, and recording to ensure consistency and accuracy
- comprehensive documentation of field observations, sample collection, and sample identification information.

Sampling procedures proposed for this project have been successfully used for a number of years on the Asplund WPCF monitoring program. The use of documented and well-known procedures provides for greater likelihood of obtaining environmental samples uncontaminated by sampling procedures or apparatus. The use of project-specific field forms and data entry sheets also provide guidance for sampling procedures. Adherence to these procedures and use of these project documents helped ensure that data collected over the course of the project were comparable and accurate and that the study results are representative of conditions existing at the sampling sites.

4.2.1 Documentation

For observations made in the field, cross-checking between personnel were used as the primary method of quality control. These included, for example, review of navigational information recorded on the drogue field log. As described in Section 2.5, sample documentation began in the field using pre-printed log forms, labels, COC forms, and pre-determined sample identification numbers that were designed specifically for use on this project. This extensive field documentation provided a paper trail that exists for each sample or field observation and ensures credibility of the data. All field records were reviewed by the field crew leader as soon as possible after sampling was completed. Completed field logs were filed at the KLI Anchorage office upon return from the survey.

Sample integrity and identification were ensured by the COC program. The chain of custody procedure documented the handling of a sample from the time the sample was collected to the arrival of the sample at the laboratory. At the time of shipment, the field personnel kept a copy of the completed chain of custody form, and the original accompanied the samples to the laboratory.

4.2.2 Sample Handling

Samples were frozen, chilled, and/or preserved as required by the appropriate methods in the field and until receipt at the laboratory. Samples were packed in coolers along with the completed COC forms for shipment to analytical facilities as described in Section 2.0. Coolers were securely packed with ice packs as required and sealed with signed and dated fiber tape for shipment.

4.2.3 Navigation

As described above, navigation was accomplished with a DGPS system. The accuracy of the DGPS coordinates were verified by positioning the vessel over the diffuser during a low slack tide when the boil was evident and comparing DGPS readings with the known outfall location. Intertidal stations were re-occupied using a hand-held DGPS, distance and bearings, and visual sightings to temporary benchmarks and landmarks. All station information was entered on the appropriate field logs and reviewed by the field leader.

4.2.4 Field Instrumentation

Field equipment used for collection, measurement, and testing was subject to a strict program of control, calibration, adjustment, and maintenance. Care was taken to ensure that the instruments used for field measurements of temperature, salinity, DO, and pH were calibrated and adjusted

with appropriate standards prior to and after each sampling event. The standards of calibration are in accordance with applicable criteria such as the U.S. Bureau of Standards, American Society of Testing and Materials (ASTM) Standards, and follow the instrumentation manufacturer's recommended procedures.

Temperature calibration was ensured by pre-calibration at the factory and field checks of the electronic temperature sensor against a research grade thermometer reading taken from the same sample at the same time. The electronic sensor for salinity (conductivity) was also pre-calibrated at the factory and field checked against six ambient water samples which were collected for the analysis of salinity (SM 2520B) to verify the proper operation of the probe. The DO probe was also pre-calibrated at the factory. For pH, the electronic sensor probe was pre-calibrated using three known buffer solutions.

4.2.5 Sampling Variability

Sampling variability was documented by sampling three replicates at one station for the water quality parameters. This included three replicate Niskin[®] bottle casts to obtain replicate turbidity samples and three replicate grabs at the surface for fecal coliform, color, and TRC analyses. In addition, triplicate casts of the CTD for pH, DO, temperature, and salinity were performed at one station in order to check reading variability from the probe's electronic sensors.

4.2.6 Field Check Samples

Field check samples include trip blanks for volatile organic analyses for EPA Methods 602 and 624, field blanks, field generated duplicates, and standard reference materials (SRMs), spikes or other samples of known concentration that may be sent to the laboratory. With the exception of the trip blanks which are initiated at the laboratory, most of these samples were sent to the laboratory as blind samples to ensure unbiased reporting of results.

4.3 LABORATORY QUALITY CONTROL

Analytical quality control for this project included the following:

- adherence to documented procedures, particularly EPA methods, internal laboratory protocols, and respective laboratory QA/QC programs
- calibration of analytical instruments
- ability of each analytical laboratory to meet analytical precision, accuracy, limits of detection, and limits of quantification that meet EPA requirements
- use of quality control samples, internal standards, and surrogate solutions

The analytical laboratories used on this project operate under the quality assurance (QA) programs described in their QA management plans. These programs involve the participation of qualified and trained personnel; the use of standard operating procedures for analytical methodology and procedures; a rigorous system of documenting and validating measurements; maintenance and calibration of instruments; and the analysis of quality control samples for precision and accuracy tracking. The pertinent methods descriptions the laboratories are following are comprehensive and provide information concerning proper sample collection, processing, storage, and preservation; required apparatus and materials; analytical procedure;

standardization and calibration techniques; quality control samples required; methods of calculating values and assessing data quality; and reporting and performance criteria.

4.3.1 Documentation

Documentation in the laboratory included finalizing the original COC forms and generating the internal documents that track samples through the laboratory (e.g., sample control logs, refrigerator logs, etc.). Any deviations from the prescribed methods or internal laboratory standard operating procedures (SOPs) were documented in the project files. Data affected by such deviations were appropriately qualified, as was any data that did not meet acceptable quality criteria. Typical data qualifiers included those denoting estimated concentrations (J) or not detected (ND or U).

4.3.2 Calibration

Calibration is an integral part of any instrumental analysis. Calibration requirements for each type of analysis to be used on this project are described in the appropriate methods. Typically, instrument calibration was performed daily or on a per batch basis.

4.3.3 Quality Control Procedures

Internal laboratory quality control checks included the use of surrogate solutions and quality control samples such as procedural (or method) blanks, matrix spike/spike duplicates, standard reference materials (SRMs) or EPA QC check samples, and duplicates as specified in the EPA approved analytical procedures. Surrogate compounds were spiked into samples as appropriate to measure individual sample matrix effects that are associated with sample preparation and analysis. This includes QC samples such as procedural blanks and matrix spike samples. Surrogate compound analyses were reported in percent recovery. Results from quality control samples allow the assessment of quality assurance parameters such as accuracy and precision of the data. Any data falling outside the acceptable criteria as defined in the methods were appropriately investigated and qualified.

Method blanks are pure, organic- or metal-free reagent water that are run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. Method blanks were analyzed as called for by each method, typically one per day or one per sample batch.

Laboratory accuracy was assessed by routine spiking of environmental samples with a standard addition as called for by the appropriate method. Sample spikes and matrix spike/matrix spike duplicates were run on the organic analyses collected as part of both the influent, effluent, and sludge and receiving water monitoring components of the program. These samples are fortified with components of interest following the initial analysis to check the ability of the method to recover acceptable levels and to determine accuracy of the data. Quality control charts are prepared by the laboratories where applicable to show the range of individual measurements encountered by following procedures such as those outlined in *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (EPA, 1982b) and other guidance documents (e.g. EPA, 1994a and 1994b).

Trace metals analyses for the monitoring were supported through the use of standard reference materials (SRMs), which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards and other sources. These SRMs were analyzed by the laboratory at the same time as the program samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery.

Analytical and instrument variability was checked by laboratory splitting of one larger-volume field sample per survey into triplicates and analyzing the subsamples for the various water quality parameters. The individual measurements and concentration ranges were reported for each parameter of each split. In addition, duplicate analyses of samples split in the laboratory were used as a means to assess laboratory precision.

For other water quality parameters, the following summary of QA/QC procedures will apply:

- Fecal Coliform Bacteria: *Escherichia coli* was used as a positive control for each analytical run. *Pseudomonas aeruginosa* was used as a negative control, and buffered dilution water was used as a blank. In addition, 10 % of the samples were run in duplicate.
- Enterococci Bacteria: *Streptococcus faecalis* was used as a positive control for each analytical run. *Escherichia coli* was used as a negative control, and buffered dilution water was used as a blank.
- Color: Fresh color standards were made prior to the beginning of the program. Samples were allowed to settle and were pre-treated with paper filtration to remove turbidity and reported as "true color".
- Turbidity: The instrument was calibrated with a 20.0 NTU standard provided by the manufacturer. Due to the high turbidity in Cook Inlet, all samples were run at the 10X scale on the nephelometer to ensure that the measured turbidities were within the range of the instrumentation. In addition, select samples were run in duplicate.
- Total Residual Chlorine: TRC was run by amperometric titration which requires a blank and laboratory control and laboratory control spike samples every ten samples. The amperometric titrant was standardized daily.
- Salinity: A seawater salinity standard was used to check the instrumental accuracy of the salinometer every half-hour or every ten samples whichever is more frequent.

4.3.4 Method Detection Limits

The method detection limits (MDLs), practical quantification limits (PQLs), or method reporting limits (MRLs) for the various analytes were determined using the appropriate method as described in the protocols. These MDLs, PQLs, and MRLs have been reported with the data (see appendices) and included in summary data tables as appropriate. Concentrations below the MDL, PQL, or MRL were typically qualified with the "ND" code for non-detect.

4.4 DATA REVIEW AND VALIDATION

Data were verified by performing comparisons of final data against the original documentation, including the workplan, field logs and data sheets, and analytical reports. Any discrepancies were fully documented in the program files and reported in the annual report. Data were validated according to accuracy, precision, and completeness for both the field sample collection and analytical laboratory components of the program. Qualitative evaluation and statistical procedures were used to check the quality of the field and chemical data as appropriate. The primary goals of these review and validation procedures are to ensure that the data:

- are representative of conditions in the study area
- are accurate
- demonstrate the required level of precision
- are comparable with data from other NPDES programs
- are acceptable for use as a tool to evaluate permit compliance
- allow independent technical appraisal of the program's ability to meet the monitoring objectives.

Analytical data were subjected to review upon receipt from the laboratory following guidelines such as those published in *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994a), or *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1994b). Items reviewed during data validation included sample holding times, results for laboratory method blanks, matrix spike/spike duplicates (MS/SD), check standards or SRMs, field and laboratory duplicates, field and trip blanks, report completeness, and laboratory performance (i.e., ability to achieve method detection limits and adherence to QA/QC criteria established for this program). Items failing to meet such validation and review procedures were noted and corrected, if possible. Items that could not be corrected and fell outside of acceptable limits (e.g., a sample analyzed outside holding time) have been noted in this annual report if they occur.

4.5 QUALITY ASSURANCE/QUALITY CONTROL RESULTS

4.5.1 Field Instrumentation and Sampling Quality Control Results

For influent, effluent, and sludge monitoring, field-generated duplicate influent and/or effluent samples were collected for the analysis of pesticides during the June 2007 sampling. During the June 2007 sampling, duplicate effluent samples were collected for metals (dissolved antimony, beryllium, cadmium, lead, selenium, and thallium). Results for these duplicate analyses are provided in Table 9 and Table 10 and the appendices, and were found to be within acceptance limits. Results from duplicate field samples collected for certain parameters during the receiving water sampling such as volatile organics, metals, cyanide, turbidity, and TSS are reported in the appropriate tables (Table 15, Table 16, and Table 17), and were found to be within acceptance limits.

Field blanks were collected for several parameters during each sampling event by pouring HPLC-grade deionized (DI) water into the appropriate sampling containers with the correct preservative. Trip blanks consisted of DI blank samples prepared at the laboratory that went through the same shipping and handling procedures as all the other sample containers of each

analytical type; these remained unopened in the field. Field blanks and trip blanks analyzed using EPA Method 602 showed no measurable levels of the target compounds during the receiving water monitoring (Appendix D2). Trip blanks analyzed in conjunction with the EPA 624 analyses for June and August 2007 showed only trace levels of methylene chloride (Appendices A2 and B2). Additionally, the field blanks analyzed in conjunction with the EPA 624 analyses for both June and August 2007 showed trace levels of methylene chloride. This compound was also detected in the influent and effluent for both sampling events and in the laboratory method blank during August. Methylene chloride is a common laboratory contaminant that often shows up in both field samples and laboratory blanks. Values reported for these parameters are qualified with the "B" qualifier to indicate laboratory contamination (Table 9 and Table 10).

Sampling variability for water quality parameters (fecal coliform bacteria, color, turbidity, and TRC) was determined by analyzing three discrete surface samples taken at Station C2-2S (Table 19). Where appropriate, the mean, standard deviation, and coefficient of variation are included in Table 19 to provide a measure of variability for the listed parameters. The coefficient of variation for the various sample types was found to be 25 % for color, 0 % for TRC and 0.38 % for turbidity.

Three replicate fecal coliform samples were also collected at Station C2-2. Two of the three samples yielded the same result (<2 FC MPN/100 mL) while the third yielded a result of 2 FC MPN/100 mL. Mean, standard deviation, and coefficient of variation are not determined for fecal coliform due to nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the ± 95 % confidence limits for each sample are typically provided. Fecal coliform values were within the confidence limits.

Variability and calibration checks of the electronics probe were done by performing repeated profiles of temperature, pH, DO, and salinity at one station (C2-2). Results of these calibration checks for the Seabird CTD show that probe variability for temperature, pH, and DO was extremely low in all cases with a coefficient of variation of <0.28 % (Table 20). Probe variability for salinity was only slightly higher with a maximum coefficient of variation of <0.75 %. Salinity data obtained from the CTD were compared with salinity grab samples to confirm that the instrument was within calibration. In addition, a precision thermometer was used to verify CTD temperature readings, and the pH sensor was calibrated against three standards prior to field deployment at KLI's laboratory facilities. The salinity, temperature, and pH probes were found to be accurate and within calibration during the survey.

4.5.2 Laboratory Quality Control Results

Full analytical data and laboratory case narratives are provided for each laboratory in the appendices. Laboratory duplicate analyses, where performed, were found to have a high degree of precision and were within the acceptance criteria for relative percent difference (RPD). Laboratory duplicates were performed for a number of organic analyses and were found to be within acceptance limits. A number of duplicate confirmation results, however, did exceed QC criteria and have been appropriately qualified in their respective tables. One pesticide exceeded 40 % RPD between the primary and confirmation columns in the June 2007 effluent sample and two pesticides in the sludge sample. During the August 2007 sampling event, two pesticides in the effluent sample also exceeded RPD criteria. All data were appropriately qualified.

Table 19. Sampling and Laboratory Variability for Water Quality Samples, 19 and 20 June 2007.

Station	Subsample Designation	Fecal Coliform* (MPN/100 mL)	Color (units)	Turbidity (NTU)	TRC (mg/L)
SAMPLING VARIABILITY					
C2-2S	A	<2 [---]	25	263	<0.010
	B	<2 [---]	15 / 15	265	<0.010
	C	2 [1.0-10]	20	264	<0.010
Mean	---	---	20	264	<0.010
Standard Deviation	---	---	5	1	0
Coefficient of Variation (%)	---	---	25	0.38	0
LABORATORY VARIABILITY					
C3-1S	A	<2 [---]	20	271	<0.010
	B	<2 [---]	20	270	NA
	C	<2 [---]	20	278	NA
Mean	---	---	20	273	---
Standard Deviation	---	---	0	4.36	---
Coefficient of Variation (%)	---	---	0	1.60	---
C1-4S	A	NA	NA	323	NA
	B	NA	NA	323	NA
Relative % Difference	---	---	---	0	---
C2-2B	A	NA	NA	420	NA
	B	NA	NA	418	NA
Relative % Difference	---	---	---	0.5	---
C3-1M	A	NA	NA	452	NA
	B	NA	NA	444	NA
Relative % Difference	---	---	---	2	---
E1-1S	A	NA	5	NA	NA
	B	NA	5	NA	NA
Relative % Difference	---	---	0	---	---
E1-2S	A	NA	NA	46	NA
	B	NA	NA	86	NA
Relative % Difference	---	---	---	61	---
E1-3S	A	NA	NA	114	NA
	B	NA	NA	115	NA
Relative % Difference	---	---	---	1	---
E2-1S	A	NA	NA	205	NA
	B	NA	NA	214	NA
Relative % Difference	---	---	---	4	---
E2-3S	A	NA	NA	NA	<0.010
	B	NA	NA	NA	<0.010
Relative % Difference	---	---	---	---	0
E2-3M	A	NA	NA	387	NA
	B	NA	NA	407	NA
Relative % Difference	---	---	---	5	---

Table 19. Sampling and Laboratory Variability for Water Quality Samples, 19 and 20 June 2007. (continued)

Station	Subsample Designation	Fecal Coliform* (MPN/100 mL)	Color (units)	Turbidity (NTU)	TRC (mg/L)
E3-2B	A	NA	NA	427	NA
	B	NA	NA	433	NA
Relative % Difference	---	---	---	1	---
E3-3S	A	NA	25	NA	NA
	B	NA	25	NA	NA
Relative % Difference	---	---	0	---	---
E3-4B	A	NA	NA	334	NA
	B	NA	NA	357	NA
Relative % Difference	---	---	---	7	---
F1-4S	A	NA	NA	263	NA
	B	NA	NA	267	NA
Relative % Difference	---	---	---	2	---
F2-3M	A	NA	NA	511	NA
	B	NA	NA	492	NA
Relative % Difference	---	---	---	4	---
F2-4S	A	NA	NA	NA	<0.010
	B	NA	NA	NA	<0.010
Relative % Difference	---	---	---	---	0
F3-1S	A	NA	10	NA	NA
	B	NA	10	NA	NA
Relative % Difference	---	---	0	---	---
F3-2B	A	NA	NA	359	NA
	B	NA	NA	362	NA
Relative % Difference	---	---	---	1	---

* 95% confidence intervals indicated in brackets (American Public Health Association, 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. Washington, D.C. Table 9221.IV.)

NA Not analyzed

--- Not applicable

Table 20. Seabird SEACAT SBE-19 CTD Probe Variability Check, 20 June 2007.

Depth (m)	Temperature (°C)			Salinity (ppt)			pH (units)			DO (mg/l)			Mean (units)				Standard Deviation				Coeff. of Variation (%)			
C2-	2A	2B	2C	2A	2B	2C	2A	2B	2C	2A	2B	2C	Temp	Sal	pH	DO	Temp	Sal	pH	DO	Temp	Sal	pH	DO
0.5	13.45	13.45	13.47	13.65	13.67	13.62	7.98	7.98	7.98	9.51	9.50	9.49	13.45	13.65	7.98	9.50	0.012	0.027	0.004	0.009	0.09	0.20	0.05	0.09
1.0	13.42	13.43	13.45	13.69	13.69	13.63	7.98	7.97	7.98	9.50	9.52	9.49	13.44	13.67	7.98	9.50	0.017	0.036	0.004	0.013	0.13	0.26	0.05	0.13
1.5	13.41	13.42	13.44	13.70	13.71	13.66	7.98	7.97	7.97	9.49	9.50	9.49	13.43	13.69	7.98	9.49	0.011	0.026	0.005	0.005	0.09	0.19	0.06	0.05
2.0	13.42	13.42	13.43	13.70	13.72	13.68	7.98	7.97	7.98	9.49	9.48	9.49	13.42	13.70	7.98	9.49	0.006	0.021	0.004	0.008	0.04	0.15	0.05	0.08
2.5	13.42	13.41	13.42	13.70	13.74	13.70	7.98	7.97	7.98	9.49	9.46	9.48	13.41	13.71	7.98	9.47	0.004	0.023	0.004	0.014	0.03	0.17	0.05	0.15
3.0	13.42	13.41	13.41	13.69	13.75	13.71	7.98	7.97	7.97	9.48	9.45	9.48	13.41	13.72	7.98	9.47	0.006	0.029	0.003	0.019	0.04	0.21	0.04	0.20
3.5	13.41	13.40	13.41	13.70	13.75	13.71	7.98	7.98	7.98	9.48	9.48	9.49	13.41	13.72	7.98	9.48	0.005	0.024	0.003	0.007	0.04	0.18	0.04	0.07
4.0	13.41	13.40	13.41	13.71	13.76	13.72	7.98	7.98	7.98	9.46	9.51	9.50	13.40	13.73	7.98	9.49	0.008	0.026	0.003	0.025	0.06	0.19	0.03	0.27
4.5	13.41	13.38	13.40	13.71	13.81	13.74	7.98	7.98	7.98	9.47	9.50	9.51	13.40	13.75	7.98	9.50	0.013	0.048	0.003	0.019	0.10	0.35	0.04	0.20
5.0	13.40	13.37	13.39	13.72	13.84	13.77	7.98	7.98	7.98	9.48	9.50	9.50	13.39	13.78	7.98	9.49	0.016	0.062	0.003	0.009	0.12	0.45	0.04	0.10
5.5	13.40	13.37	13.38	13.72	13.85	13.81	7.99	7.98	7.98	9.50	9.49	9.50	13.38	13.79	7.98	9.50	0.017	0.067	0.005	0.007	0.13	0.48	0.07	0.07
6.0	13.40	13.37	13.37	13.71	13.85	13.83	7.99	7.98	7.98	9.50	9.48	9.50	13.38	13.80	7.98	9.50	0.019	0.075	0.005	0.011	0.14	0.54	0.06	0.11
6.5	13.40	13.37	13.37	13.71	13.86	13.83	7.99	7.98	7.98	9.50	9.48	9.49	13.38	13.80	7.98	9.49	0.019	0.079	0.005	0.014	0.14	0.57	0.06	0.14
7.0	13.40	13.37	13.37	13.71	13.87	13.84	7.99	7.98	7.98	9.50	9.49	9.49	13.38	13.81	7.98	9.49	0.021	0.085	0.004	0.005	0.16	0.62	0.04	0.05
7.5	13.40	13.37	13.36	13.72	13.87	13.87	7.99	7.98	7.98	9.50	9.48	9.49	13.37	13.82	7.99	9.49	0.024	0.090	0.004	0.012	0.18	0.65	0.05	0.13
8.0	13.40	13.37	13.35	13.73	13.87	13.90	7.99	7.99	7.98	9.50	9.48	9.49	13.37	13.83	7.99	9.49	0.024	0.089	0.005	0.007	0.18	0.64	0.06	0.08
8.5	13.39	13.37	13.35	13.74	13.87	13.91	7.99	7.99	7.98	9.49	9.49	9.49	13.37	13.84	7.99	9.49	0.024	0.089	0.005	0.004	0.18	0.64	0.06	0.04
9.0	13.39	13.37	13.34	13.75	13.87	13.92	8.00	7.99	7.98	9.49	9.49	9.48	13.37	13.85	7.99	9.49	0.024	0.086	0.006	0.006	0.18	0.62	0.07	0.06
9.5	13.39	13.37	13.33	13.75	13.87	13.96	8.00	7.99	7.99	9.49	9.49	9.45	13.36	13.86	7.99	9.48	0.028	0.104	0.005	0.019	0.21	0.75	0.06	0.20
10.0	13.38	13.37	13.33	13.77	13.87	13.97	8.00	7.99	7.99	9.48	9.49	9.45	13.36	13.87	7.99	9.47	0.028	0.102	0.006	0.021	0.21	0.74	0.08	0.22
10.5	13.38	13.37	13.33	13.79	13.86	13.98	8.00	7.99	7.99	9.49	9.49	9.49	13.36	13.88	7.99	9.49	0.029	0.097	0.007	0.003	0.22	0.70	0.08	0.03
11.0	13.38	13.36	13.32	13.79	13.86	13.99	8.00	7.99	7.98	9.49	9.49	9.47	13.35	13.88	7.99	9.48	0.033	0.097	0.010	0.009	0.24	0.70	0.13	0.10

In addition to the standard laboratory QC procedures, color, fecal coliform, and turbidity, samples collected at Station C3-1 during the receiving water sampling were split in the laboratory and analyzed in triplicate. Mean, standard deviation, and coefficient of variation are reported in Table 19 for these samples (where appropriate). These statistics were not determined for fecal coliform due to nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the ± 95 % confidence limits for each sample are provided in Table 19. In this case, two of the three samples had the same result. The remaining sample had a confidence limit and have been reported here. Coefficient of variation was shown to be 0 % for color and 1.6 % for turbidity. For analyses where samples were run in duplicate, such as TRC, turbidity, and color samples, the relative percent difference between duplicates was calculated. Laboratory duplicate analyses were found to generally be very low and within acceptable limits. Duplicate results for turbidity ranged from 0 to 61 % RPD. Color duplicate results showed 0 % difference between duplicates. Duplicate TRC analyses were all identical to the original sample results at <0.010 mg/L.

Laboratory accuracy was assessed through the use of surrogate recoveries, sample and control spikes and duplicates, and SRMs. Detailed QA/QC results for all contract laboratory analyses are provided in the appendices corresponding to each analysis. Surrogates are compounds that were added to each sample and QC sample that were analyzed by GC methodology, such as volatile organic compounds (EPA 602 and 624/8260B), semi-volatile organic compounds (EPA 625/8270C), pesticides (EPA 608/8081A and 614/8141A), and dioxins (EPA 8280A). Several instances of surrogate recoveries outside QC recovery limits were found during the 2007 influent, effluent, and sludge monitoring effort. These deviations are discussed in the case narratives that were provided by each laboratory which fully detail all QC issues for both sampling events and explain any QC deviations; these are provided in report Appendices. As indicated by the laboratories, the data were not significantly affected by any QC issue.

Matrix spike (MS), matrix spike duplicate (MSD), laboratory control spike (LCS), and duplicate control spike (DCS) are samples and blanks that are spiked with target compounds of interest to determine percent recovery and relative percent difference between duplicates. The QC criteria include an acceptable recovery range and an RPD that should not be exceeded. Total metals, dissolved metals, cyanide, volatile organic compounds, and semi-volatile organic compounds met QC criteria for MS, MSD, LCS, and DSC with a few exceptions for all analyses on the program. Detailed case narratives were provided by each laboratory which fully detail all QC issues for both sampling events and explain any QC deviations; these are provided in Appendices A1, A2, B1, B2, D1, D2 and D3.

Trace metals analyses for the influent, effluent, sludge, and receiving water testing were supported through the use of SRMs, which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards, National Institute of Standards and Technology, or other certified standards. These SRMs are analyzed by the laboratories at the same time as the project samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery. Except for lead in one of the seawater SRMs run in association with the receiving water program, all metals SRM results were within acceptance limits (Appendix D4). The SRM results for lead were within acceptable ranges when blank-corrected. These recovery problems were not seen in the other SRM analysis performed for these metals, and data quality was not judged to be adversely affected as other QC checks for these samples were found to be acceptable and no further corrective action was taken.

Method blanks (or procedural blanks) were also analyzed for most analyses on the program. Method blanks consist of pure, organic- or metal-free reagent grade water that is run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. With the exception of the ultra-trace level metals analyses that were conducted as part of the receiving water program, cyanide as part of the pre-treatment during June, and methylene chloride seen in the August 2007 organic analyses, all method blank results for the program showed no contamination during 2007. Chromium, copper, lead, nickel, and silver were detected in either the pre-concentration, dissolved, or total blanks and all other metals were undetected above MDLs in the blanks, so no further action was taken other than flagging the data. A detailed case narrative for these samples provided by the laboratory which fully details all QC issues is provided in Appendix D4.

Although the method blanks for the June 2007 volatile organic analyses (EPA 624) did not indicate any contamination, laboratory contamination may have occurred as methylene chloride was noted in both the trip and field blanks that consisted of HPLC grade DI water. The August 2007 summer wet influent and effluent sampling also indicated methylene chloride contamination as it was seen in the method, field, and trip blank analyses. The method blank analyses performed with the TSS analyses showed no results above method detection limits however the cyanide method blank was slightly above the MDL. In addition to the typical method blanks, buffered dilution water was used as a blank for fecal coliform and enterococci bacteriological analyses. All blanks run for fecal coliform and enterococci showed no growth. In accordance with the laboratories QA/QC policy, all sample results less than twenty times the level found in the method blank were flagged as estimated concentrations.

5.0 DISCUSSION

5.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING

The NPDES permit for the Asplund WPCF requires compliance with applicable State water quality standards as promulgated in Chapter 70 of the Alaska Administrative Code entitled "Water Quality Standards" (18 AAC 70; ADEC, 1999). This chapter requires that criteria outlined in "EPA Quality Criteria for Water" (also known as "The Red Book"; EPA, 1976), the revised quality criteria for water (EPA 1986b), and other applicable criteria as referenced in the AWQS be met in applicable receiving waters at every point outside of the ZID boundary. Also, as noted in Section 1.1.1, the State of Alaska water quality regulations include SSWQC for the Point Woronzof area of Cook Inlet for turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Since the issuance of the current Permit, EPA has approved ADEC's proposed use of dissolved metals for all of the State's marine water quality criteria, approved all of ADEC's proposed SSWQC for Upper Cook Inlet, and removed Alaska from the National Toxics Rule list (EPA 2006; Sept. 15, 2006 letter to ADEC). Except for cadmium, where the dissolved standard changed from 9.3 to 8.8 µg/L, all other dissolved metals criteria are the same as those listed in the SSWQC. Even though EPA has approved the use of dissolved metals criteria for Alaska's marine water quality criteria, the current SSWQC will most likely remain in affect for the Point Woronzof area for permit renewal. Therefore, we have used both the SSWQC and the more restrictive criteria for dissolved cadmium to evaluate the data in this report. Finally, the permit itself includes some effluent limitations that must be met. The following sections discuss the parameters of concern in regards to the requirements of the NPDES permit or the AWQS as well as historical data from the WPCF, data from other publicly-owned treatment works (POTWs), or other EPA data.

5.1.1 Influent and Effluent Monitoring

Table 21 lists permit effluent limitations and water quality criteria that are applicable to the current NPDES permit; it includes each of the parameters required to be monitored by the permit. Most of the values shown are the chronic toxicity criteria for salt water aquatic life. Chronic toxicity criteria concentrations are lower than acute toxicity criteria concentrations; therefore, the more stringent of the two values were used here for comparison. The MAEC for each constituent was calculated from the outfall design dilution factor of 142:1 (for conservative substances) or 180:1 (for non-conservative substances), the water quality criteria, and the natural background concentrations as determined at the control site near Point MacKenzie. It was assumed that the final effluent would be diluted by a minimum factor of 142 by the time it reached the boundary of the ZID. For most metals, the MAECs were calculated from the SSWQC for dissolved metals contained in the AWQS for the Point Woronzof area.

To determine compliance with State water quality standards, Table 21 can be compared with effluent values found in Table 8 through Table 11 as well as those in Table 16 and Table 17. The AWWU 2007 maximum effluent concentrations shown in Table 21 were the maximum encountered during the calendar year either during AWWU's in-plant monitoring, the toxic pollutant and pesticide monitoring events, pretreatment monitoring, or the supplemental effluent monitoring that was performed as part of the receiving water sampling. For metals, both total and dissolved concentrations in the effluent were compared against their MAEC, since it is assumed that all of the metals contained in the effluent are potentially bioavailable upon entering

Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2007 Maximum Concentrations for Effluent Comparisons. Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard ^a		Maximum Allowable Effluent Concentration ^b (MAEC)	AWWU 2007 Maximum Effluent Concentration ^c
Antimony (µg/L)	146	Human health, not listed for saltwater aquatic life	20,607	ND (3.00) ^{d,e}
Arsenic (µg/L)	36	Chronic toxicity, measured as dissolved	4,882	2.87 ^e
Beryllium (µg/L)	11	For the protection of aquatic life in soft fresh water	1,513	ND (1.00) ^{d,e}
Cadmium (µg/L)	9.3 (8.8) ^k	Chronic toxicity, measured as dissolved	1,322 (1,250)	0.229 ^f
Chromium (VI) ^h (µg/L)	50	Chronic toxicity, measured as dissolved	7,038	3.69 ^f
Copper (µg/L)	3.1	Chronic toxicity, measured as dissolved	317	42.6 ^e
Lead (µg/L)	8.1	Chronic toxicity, measured as dissolved	1,140	3.57 ^{d,e}
Mercury (µg/L)	0.025	Chronic toxicity, measured as dissolved	2.73	0.052 ^f
Nickel (µg/L)	8.2	Chronic toxicity, measured as dissolved	978	4.18 ^e
Selenium (µg/L)	71	Chronic toxicity, measured as dissolved	10,136	1.73 ^e
Silver (µg/L)	1.9	Acute toxicity, measured as dissolved	257	2.22 ^{d,e}
Thallium (µg/L)	2,130	Acute toxicity to saltwater aquatic life	306,567	ND (1.00) ^{d,e}
Zinc (µg/L)	81	Chronic toxicity, measured as dissolved	11,249	105 ^e

Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2007 Maximum Concentrations for Effluent Comparisons. (continued)
Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard ^a		Maximum Allowable Effluent Concentration ^b (MAEC)	AWWU 2007 Maximum Effluent Concentration ^c
Cyanide (µg/L)	1	For marine aquatic life	181	59 ^{d,e}
Total Aqueous Hydrocarbons (TAqH) (µg/L)	15	Growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers ^a	2,715	13.34 ^f
Total Aromatic Hydrocarbons as BETX (µg/L)	10	Same as above ^a	1,810	47.5 ^d
pH (pH units)		<i>g</i>	6.5 - 8.5	6.5 – 7.9 ⁱ
Total Residual Chlorine (TRC) (mg/L)		<i>g</i>	Daily Max. 1.2	Daily Max. 1.11 ⁱ
BOD ₅ (mg/L)	<i>g</i>		Monthly Avg. 240	Monthly Avg. 174 ⁱ
			Weekly Avg. 250	Weekly Avg. 199 ⁱ
			Daily Max. 300	Daily Max. 204 ⁱ
			Monthly Removal Rate ≥30 %	(Monthly Avg. Rate 30 - 43% ⁱ)
				Annual Removal Rate (35% in 07) ⁱ

Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2007 Maximum Concentrations for Effluent Comparisons. (continued)
Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard ^a	Maximum Allowable Effluent Concentration ^b (MAEC)	AWWU 2007 Maximum Effluent Concentration ^c
Total Suspended Solids (TSS) (mg/L)	<i>g</i>	Monthly Avg. 170 Weekly Avg. 180 Daily Max. 190 Monthly Removal Rate $\geq 30\%$	Monthly Avg. 66 ⁱ Weekly Avg. 80 ⁱ Daily Max. 122 ⁱ Monthly Avg. Rate 72 - 77% ⁱ , Annual Removal Rate 75% ⁱ
Total Ammonia (mg/L)	9.8 ^j	1,774	Monthly Max. 22.9 ⁱ
Fecal Coliform (FC MPN/100 mL)	<i>g</i>	Monthly geometric mean of at least five samples shall not exceed 850. Not more than 10% of samples shall exceed 2600.	Monthly mean maximum was 76 ⁱ More than 10% of the samples collected in May 2007 exceeded 2600ⁱ

a Alaska Administrative Code, 1999. Water Quality Standards, Chapter 70 (18 AAC 70)

b For conservative substances, effluent water quality criteria were determined by assuming a dilution of 142:1 at the ZID boundary, where: MAEC = 142 * (Criteria - Natural Background Concentration) + Criteria; pollutant concentrations in the effluent should not exceed these values. For non-conservative substances, a dilution of 180:1 was utilized in the MAEC calculation.

c For metals, the maximum effluent concentration was determined from both total and dissolved concentrations.

d Values from June 2007 or August 2007 toxic pollutant and pesticide samplings.

e Values from AWWU's pretreatment program.

f Values from effluent tested during receiving water sampling event.

g MAECs are not based on water quality criteria but instead are specified in MOA's 2000 NPDES permit.

h All samples tested as total chromium.

i Values from AWWU's in-plant monitoring.

j Ammonia receiving water criteria based on pH of 8.0, temperature of 15.0°C, and salinity of 20‰.

k Cadmium standard based on new revised EPA level that was approved for State of Alaska.

the receiving water. All effluent concentrations were found to be much lower than the MAECs from the permit or computed from the water quality standards provided for in the AWQS. In addition, the permit limitations for all but one parameter (fecal coliform) were met for the 2007 program year. When the MAECs in Table 21 were compared to AWWU's self-monitoring effluent data, the toxic pollutant and pesticides sampling events (June and August 2007), the pretreatment monitoring data, and the effluent data from the receiving water sampling, no metals or cyanide values exceeded their MAECs. The highest concentrations of either total or dissolved metals seen in 2007 were all well below their respective MAECs. The one metal that most closely approached its MAEC at any time was copper, and this was considerably below its MAEC. The maximum concentration of total copper was 42.6 µg/L compared to a MAEC of 317 µg/L. The highest dissolved copper concentration that was seen was 29 µg/L.

Those metals without SSWQC, while analyzed as both total and dissolved metals as called for by the permit, are compared to total recoverable metal MAECs as provided by EPA criteria and as called for by the AWQS. Total metals concentrations for antimony, beryllium, and thallium were generally low, often below detection limits, and all well below their MAECs. As in past years, total recoverable metals detected in the influent and final effluent were compared with data from an EPA study of 40 Publicly Owned Treatment Works (POTWs) in Table 22 (EPA, 1982a). Without exception, metals and cyanide values were lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants.

Historic influent and effluent total recoverable metals and cyanide concentrations collected as part of AWWU's self-monitoring program are presented in Table 23 and Table 24. It should be noted that under the previous permit, the reporting year was November - October, which differs from the current permit's reporting period of the calendar year. In addition, prior to 2000 when the permit requirements changed, dissolved metals had only been analyzed in a single sample of effluent collected each year during the receiving water sampling. Beginning in August 2000, dissolved metals from the effluent have been analyzed in both the summer wet and summer dry sampling events and as part of the pretreatment monitoring. Concentrations are low and fairly consistent over time. Concentrations of total recoverable metals concentrations seen in the influent and effluent during 2007 generally fell within the range of concentrations seen during prior years. Although within the range previously seen, cyanide concentrations appeared to be slightly elevated in 2007. Concentrations of dissolved metals were generally found to fall within range of concentrations seen since August 2000 when this type of analysis was initiated.

During previous years, total copper levels would sometimes exceed the previous permit's MAEC of 100 µg/L. While this permit limit is no longer in effect, it is interesting to note that the maximum total copper concentration encountered in the effluent during the year 2007 (from the pretreatment monitoring) was considerably lower at 42.6 µg/L. The reasons for the elevated copper concentrations in previous years were investigated and reported to the Municipality by CH2M Hill and the AWWU laboratory. The conclusion of the copper investigation was that most of the copper in the influent is from the leaching of copper from residential plumbing rather than industrial discharge (CH2M Hill, 1987; CH2M Hill et al., 1988). Neither enforcement of the sewer ordinance (AMC 26.50) nor the industrial pretreatment program was expected to significantly reduce the amounts of copper received at the Asplund WPCF. The mass of copper in the plant influent and effluent remained fairly constant from 1986 through 1991. From 1991 to 1992, the in-plant copper loading dropped by approximately 25 %. The exact cause of this

Table 22. Comparison Between Influent/Effluent Analysis Results for Anchorage and 40 POTWs.^a

Parameter	Anchorage Values				40 POTW Study Values				
	2007 Concentration ^{b,c} (µg/L)				Frequency of Detection (%)		Range Detected (µg/L)		Influent Median
	Summer-Dry		Summer-Wet		Influent	Secondary Effluent	Influent	Secondary Effluent	(µg/L)
	INF	EFF	INF	EFF					
VOLATILES ^d									
Benzene	0.30 J	0.58 J	0.33 J	0.27 J	61	23	1-1560	1-72	2
Chloroform	4.3 J	3.4 J	2.3 J	3.8 J	91	82	1-430	1-87	7
Chloromethane	ND (10.0)	ND (10.0)	ND (10.0)	1.7 J	NA	NA	NA	NA	NA
1,3 Dichlorobenzene	ND (5.0)	9.5	ND (5.0)	ND (5.0)	7	2	1-270	5-5	NA
1,4 Dichlorobenzene	ND (5.0)	9.5	1.5 J	0.98 J	17	3	2-200	3-9	NA
Ethylbenzene	0.56 J	2.9 J	2.4 J	0.62 J	80	24	1-730	1-49	8
Methylene chloride	3.2 J	3.1 J	5.0 B	3.5 J,B	92	86	1-49000	1-62000	38
Tetrachloroethene	0.95 J	6.4	4.6 J	2.5 J	95	79	1-5700	1-1200	23
1,1,2,2-Tetrachloroethane	ND (5.0)	3.3 J	ND (5.0)	ND (5.0)	7	3	1-52	1-5	NA
Toluene	9.3	21	8.7	8.1	96	53	1-13000	1-1100	27
Xylene (Total)	3.3 J	23	13	3.1 J	NA	NA	NA	NA	NA
SEMI-VOLATILES ^d									
Bis(2-ethylhexyl)phthalate	15 J	20 J	18 J	20 J	92	84	2-670	1-370	27
Diethyl phthalate	9.3 J	10 J	ND (3.8)	ND (3.8)	53	13	1-42	1-7	3
Phenol	74	24 J	45 J	25 J	79	29	1-1400	1-89	7
TOTAL METALS & OTHER COMPONENTS									
Antimony	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	14	13	1-192	1-69	NA
Arsenic	2.31	2.18	1.29	1.83	15	12	2-80	1-72	NA
Beryllium	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	3	1	1-4	1-12	NA
Cadmium	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	56	28	1-1800	2-82	3
Chromium	3.24	2.09	1.50	1.90	95	85	8-2380	2-759	105
Copper	64.4	40.7	30.2	34.8	100	91	7-2300	3-255	132
Lead	3.78	2.08	2.29	3.57	62	21	16-2540	20-217	53
Mercury	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	70	31	0.2-4	0.2-1.2	0.517
Molybdenum	10.5	10.8	5.43	6.81	NA	NA	NA	NA	NA
Nickel	5.25	3.91	3.61	4.05	79	75	5-5970	7-679	54
Selenium	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	9	10	1-10	1-150	NA
Silver	2.57	2.22	1.22	1.26	71	25	2-320	1-30	8
Thallium	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	3	2	1-19	1-2	NA
Zinc	138	83.8	55.1	84.8	100	94	22-9250	18-3150	273
Cyanide	6.0 J	9 J/9 J/10	11.0/10.0	59.0	100	97	3-7580	2-2140	249

^a Source: EPA, 1982. *Fate of Priority Pollutants in POTWs*. Final Report, Volume I, Effluent Guidelines Division, WH-552, EPA 440/1-82/303

^b Data from NPDES 2007 toxic pollutant and pesticide monitoring

^c Duplicate analyses provided for some analyses (value/lab duplicate value)

^d Only analytes detected in either the influent or effluent are included

B Also detected in associated method blank

J Estimated value

NA Not available

ND Not detected

Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. Values in brackets are from EPA Method 602 where available.

Pollutant	2002		2003		2004	
	Dry ^b	Wet ^{b,c}	Dry ^b	Wet ^b	Dry	Wet
	7/22-23	8/26-27	6/25-26	8/12-13	6/23-24	8/23-24
ORGANICS (µg/L)						
Benzene	ND[0.58/0.59]	ND[ND/ND]	ND[ND/ND]	ND[ND/ND]	ND[0.24 J]	ND
Bis-(2-ethylhexyl) phthalate	11	8.9 J /21	18 B	13	16	15
Bromomethane	ND	ND	7.0 J	ND	ND	ND
Butyl benzyl phthalate	3.3 J	ND/ND	3.0 J	ND	ND	4.2 J
Chloroform	4.3 J	4.8 J	3.8 J	3.2 J	3.2 J	3.6 J
Chloromethane	ND	ND	ND	ND	ND	ND
*1,3-Dichlorobenzene	ND	ND	ND[ND/ND]	ND[ND/ND]	ND	ND
*1,4-Dichlorobenzene	ND	ND	ND[ND/ND]	ND[1.2/1.2]	ND	ND
Diethyl phthalate	8.9 J	6.0 J/7.5 J	7.3 J	11	8.5 J	7.4 J
Di-n-butyl phthalate	2.9 J	ND/ND	1.6 J	ND	1.7 J	ND
Ethylbenzene	ND [0.62/0.61]	ND[0.80/0.81]	ND[1.8/1.1]	ND[1.1/1.3]	ND[0.37J,COL]	ND
Methylene Chloride	5.0 B	0.94 J	4.1 J	2.9J	4.4 J	4.7 J,B
Phenol	24	11/ND	18	23	19	19
Tetrachloroethene	ND	0.95 J	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND
Toluene	9.1[11/10]	8.2[6.2/6.4]	7.4[5.8/6.4]	5.3[9.0/9.6]	5.9[6.4]	7.2
* Total Xylenes	NT[3.0/2.8]	NT[5.7/5.8]	5.1 J[6.9/8.3]	ND[14/15]	ND[1.3COL]	ND
Total Hydrocarbons as Oil and Grease ^a	21800	23500	24000	20100	26300	25400
Total Aromatic Hydrocarbons as BETX ^c	NT[15.2/14]	18.2[13.2/13.5]	22.5[15.5/16.8]	25.3[24.6/26.4]	25.9[8.31]	27.2
OTHER						
Cyanide (µg/L)	ND	ND	ND	ND	ND	ND
Asbestos (million fibers/L)	20	6.6	ND	ND	ND	ND

Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued) Values in brackets are from EPA Method 602 where available.

Pollutant	2005		2006		2007	
	Dry	Wet	Dry	Wet	Dry	Wet
	5/23-24	8/1-2	6/27-28	8/15-16	6/19-20	8/7-8
ORGANICS (µg/L)						
Benzene	ND [ND]	3.3 J	ND [0.43J]	0.59 J	0.58 J[ND]	0.27 J
Bis-(2-ethylhexyl) phthalate	15	14 B	18	10	20 J	20 J
Bromomethane	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	7.4 J	2.7 J	ND	ND	ND	ND
Chloroform	2.6 J	4.1 J	3.6 J	3.8 J	3.4 J	3.8 J
Chloromethane	ND	1.4 J	ND	1.1 J	ND	1.7 J
* 1,3-Dichlorobenzene	ND	ND	ND	ND	9.5	ND
* 1,4-Dichlorobenzene	ND	ND	1.0 J	1.1 J	9.5	0.98 J
Diethyl phthalate	8.5 J	10	7.7 J	7.9 J	10 J	ND
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND [ND]	ND	ND [3.8]	0.62 J	2.9 J[ND]	0.62 J
Methylene Chloride	2.6 J,B	5.0 B	4.5 J	3.3 J,B	3.1 J	3.5 J, B
Phenol	19	21	18	13	24 J	25 J
Tetrachloroethene	ND	ND	4.0 J	1.4 J	6.4	2.5 J
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	3.3 J	ND
Toluene	4.0 J [5.6]	10	8.7 [11]	8.7	21[4.9]	8.1
* Total Xylenes	1.5 J [0.93]	2.4 J	6.7 J [17]	3.1 J	23 [2.6]	3.1 J
Total Hydrocarbons as Oil and Grease ^a	21400	17600	19900	19400	14900	34500
Total Aromatic Hydrocarbons as BETX	15.5 [7.53]	20.7	25.4 [32.23]	13.0	47.5 [8.5]	12.1
OTHER						
Cyanide (µg/L)	ND	ND	5	ND	9J/9J/10	59
Asbestos (million fibers/L)	ND	ND	ND	ND	ND	ND

Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued) Values in brackets are from EPA Method 602 where available.

Pollutant	2002		2003		2004	
	Dry	Wet ^b	Dry	Wet ^b	Dry	Wet ^b
	7/22-23	8/26-27	6/25-26	8/12-13	6/23-24	8/23-24
TOTAL METALS (µg/L)						
Antimony	ND	ND/ND	ND	ND/ND	ND	ND/ND
Arsenic	3	ND	3	5	ND	ND
Beryllium	ND	ND	ND	0.07	0.2	0.1
Cadmium	ND	0.4	ND	0.7	ND	ND
Chromium	1.5	3.0	7	2	4	ND
Copper	60.4	61	60	49	63	65
Lead	6	9.0	7	2	12	4
Mercury	ND	ND	0.13	0.1	0.11	0.70
Molybdenum	NT	NT	NT	NT	NT	NT
Nickel	4	3	1	5	5	ND
Selenium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Silver	6.4	6.0	3.3	2.8	3.9	ND
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	139	80	70	69	140	76
DISSOLVED METALS (µg/L)						
Antimony	ND	ND/ND	ND	ND/ND	ND	ND/ND
Arsenic	ND	3	ND	4	ND	ND
Beryllium	ND	0.46	ND	ND	ND	0.1
Cadmium	0.5	0.2	ND	0.9	0.6	ND
Chromium	ND	1.7	ND	1	ND	ND
Copper	34.9	39	27	39	27	49
Lead	5	1	7	ND	4	8
Mercury	ND	ND	0.05	ND	ND	ND
Molybdenum	NT	NT	NT	NT	NT	NT
Nickel	6	3.0	3	3	6	ND
Selenium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Silver	0.5	1.1	0.6	ND	ND	0.6
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	87	40	30	69	40	12
PESTICIDES (µg/L)						
Aldrin	ND	0.081	ND	ND	ND	ND
alpha-BHC	ND	0.10	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND	ND	ND
delta-BHC	ND	0.86	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND	ND	ND
Malathion	ND	ND	0.31	ND	ND	ND

Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued) Values in brackets are from EPA Method 602 where available.

Pollutant	2005		2006		2007	
	Dry	Wet ^b	Dry	Dry	Dry	Wet
	5/23-24	8/1-2	6/27-28	8/15-16	6/19-20	8/7-8
TOTAL METALS (µg/L)						
Antimony	0.65	ND/ND	0.65	0.58/0.60	ND	ND
Arsenic	3	2	2.4	2.6/2.8	2.18	1.83
Beryllium	0.1	ND	ND	ND/ND	ND	ND
Cadmium	0.3	ND	0.27	0.24/0.25	ND	ND
Chromium	5	3	2.2	2.8/2.7	2.09	1.90
Copper	52	54	51	49/48	40.7	34.8
Lead	6	2	2.7	2.9/2.9	2.08	3.57
Mercury	0.10	0.11	0.13	0.10	ND	ND
Molybdenum	NT	NT	NT	NT	10.8	6.81
Nickel	4	4	2.8	4.2/4.3	3.91	4.05
Selenium	0.47	ND/ND	1.4	1.4/ND	ND	ND
Silver	1.7	1.4	3.1	2.3/2.4	2.22	1.26
Thallium	ND	ND/ND	ND	ND/ND	ND	ND
Zinc	90	90	100	97/96	83.8	84.8
DISSOLVED METALS (µg/L)						
Antimony	0.45	ND/ND	ND	ND	ND/ND	ND
Arsenic	2	2	1.2	1.9	1.93/1.95	1.69
Beryllium	0.1	ND	ND	ND	ND/ND	ND
Cadmium	ND	ND	ND	ND	ND/ND	ND
Chromium	4	2	0.79	0.55	1.32/1.50	1.33
Copper	37	42	1.4	26	25.4/25.2	26.9
Lead	6	2	0.064	0.42	ND/ND	2.34
Mercury	ND	ND	0.035	0.027	ND	ND
Molybdenum	NT	NT	NT	NT	9.95/10.2	6.19
Nickel	ND	ND	3.7	2.9	3.24/3.33	3.54
Selenium	ND	ND/ND	9.6	1.1	ND/ND	ND
Silver	ND	0.9	ND	ND	1.01/1.07	ND
Thallium	ND	ND/ND	ND	ND	ND/ND	ND
Zinc	40	40	3.3	35	48.7/48.0	49.5
PESTICIDES (µg/L)						
Aldrin	ND	ND	ND	ND	ND	ND
alpha-BHC	ND	ND	ND	0.023 J	ND	ND
beta-BHC	ND	0.037 J	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	0.010 J,COL	0.021 J	ND	ND
Endosulfan II	0.075 J	ND	ND	0.042 J	ND	ND
Endrin	ND	ND	ND	ND	ND	0.011 J, COL
Endrin ketone	ND	ND	0.012 J,COL	ND	ND	ND
Heptachlor	0.17 J	0.99	ND	0.54	0.015 J, COL	0.58
4,4'-DDD	ND	ND	ND	ND	ND	0.047 J
4,4'-DDE	ND	ND	0.0080 J,COL	ND	ND	0.016 J, COL
Malathion	0.49 J, CHI	ND	ND	ND	ND	ND

^a EPA method 1664 HEM ^b Duplicate effluent collected (field duplicate) or analyzed (lab duplicate) shown as value/duplicate value

^c Values from EPA Method 624 are the result of averaging eight samples with zero used for ND (2002 Wet)

* Non-priority pollutants J Estimated value CHI More than 40% RPD between primary and confirmation results. The higher of the two results is reported. COL More than 40% RPD between primary and confirmation results. The lower of the two results is reported.

B Compound also detected in method blank ND Not detected NT Not tested

Table 24. Historical Discharge Monitoring Data (1986 - Present) for Influent and Effluent Total Metals and Cyanide. Concentrations are in µg/L. Values represent a range of minimum (Min) and maximum (Max) results for 1986-2001 as available. Results for 2002-2007 are from pretreatment monitoring (Avg of six results from both the wet and dry sampling events).

Year	Average Flow (mgd)	Arsenic		Beryllium		Cadmium		Copper		Lead		Mercury		Nickel		Silver		Zinc		Chromium		Cyanide	
		Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.
1986-2001 Min	23	<1	<1	<0.03	<0.03	0.4	0.2	36	10	<1	<1	<0.1	<0.1	<1	<1	2.1	1	54	38	<1	<1	<0.4	1
1986-2001 Max	40	26	16	0.6	0.2	20	30	280	150	149	50	3.0	1.5	77	60	30.4	98	260	240	112	120	85	50
2002 Avg	29	4	3	0.12	.082	0.5	0.4	92	63	10	6	0.4	0.1	6	4	9	6	165	158	4	3	10	10
2002 Min	27	<3	<3	0.06	<0.04	0.4	0.4	77	59	7	5	0.1	<0.1	5	3	7	4	110	80	3	1.5	<10	<10
2002 Max	34	4	3	0.22	0.21	0.6	<0.5	108	68	12	9	1.6	0.1	9	5	13	11	239	407	6.7	4.1	<10	<10
2003 Avg	28	3	3	0.09	0.09	0.8	0.6	88	57	11	5	0.3	0.1	4	5	5.6	3.3	133	79	5	3	<10	<10
2003 Min	26	1	1	0.07	0.07	0.5	<0.5	79	49	5	2	0.2	0.1	2	<1	4.3	2.7	100	69	2	2	<10	<10
2003 Max	31	5	5	0.11	0.11	1.0	0.7	110	65	19	7	0.4	0.2	6	13	6.7	3.9	151	100	9	7	<10	<10
2004 Avg	29	3	2	0.2	0.2	0.4	<0.3	83	58	10	6	0.4	0.2	7	5	5.9	3.2	169	120	5	4	<10	<10
2004 Min	26	<2	<2	0.1	0.1	<0.3	<0.3	71	46	6	4	0.1	0.1	<6.2	<6.2	<1.5	<1.5	140	76	<6.2	<6.2	<10	<10
2004 Max	34	4	2	0.2	0.3	<6.2	<6.2	99	68	12	12	0.9	0.7	8	<6.2	7.2	3.9	192	150	<6.2	<6.2	<10	10
2005 Avg	28	3	3	0.1	0.1	0.4	0.3	90	53	7	4	0.3	0.1	9	5	3.3	1.7	155	92	6	4	<0.9	<0.9
2005 Min	24	2	<2	<0.1	<0.1	<0.3	<0.3	78	47	4	2	0.1	0.1	6	4	2.8	1.3	140	80	4	1	<0.9	<0.9
2005 Max	30	4	4	0.1	0.1	0.4	0.3	116	57	10	6	0.5	0.1	17	8	4.3	2.2	180	110	7	7	<0.9	<0.9
2006 Avg	28	3	3	0.5	0.5	0.4	0.3	84	57	5	3	0.1	0.1	7	4	4	3	190	99	7	3	1.0	1.7
2006 Min	26	3	2	<0.5	<0.5	0.3	0.2	75	48	2	2	0.1	0.1	4	3	2	2	180	94	4	2	<1.0	<1.0
2006 Max	32	3	3	<0.5	<0.5	0.5	0.4	93	77	8	4	0.2	0.1	11	6	6	3	200	110	15	7	<1.0	5
2007 Avg	32	2	2	<1.0	<1.0	<1.0	<1.0	63	39	4	2	0.3	<0.2	5	4	3	2	156	90	4	2	14	22
2007 Min	24	1	2	<1.0	<1.0	<1.0	<1.0	30	34	2	2	<0.2	<0.2	4	4	1	1	55	79	2	2	6	9
2007Max	40	3	3	<1.0	<1.0	<1.0	<1.0	94	43	10	4	0.9	<0.2	9	4	3	2	299	105	7	3	25	59

Inf. Influent
 Eff. Effluent
 mgd million gallons per day

decrease is unknown; however, an increase in pH (to approximately 8.0) at the Water Treatment Facilities (Ship Creek and Eklutna) during the spring of 1991 caused a decrease in copper concentrations taken from "first draw" residential water sources in Anchorage. This increase in alkalinity was implemented to reduce corrosion in the drinking water distribution system. It would follow that these decreased values in drinking water would also affect the influent concentrations.

Total arsenic concentrations in the final effluent had remained fairly steady over the last five years, and 2007 values remained well within the historic range. The maximum total arsenic concentration in final effluent seen during 2007 was 2.87 µg/L, compared to an MAEC of 4,882 µg/L (Table 21). Arsenic values are not a serious concern for this permit in terms of effluent concentrations, since the concentration in the final effluent is so much lower than the MAEC.

During August 2007, 59 µg/L of cyanide was reported in the effluent during the first day of pretreatment monitoring efforts, well below the MAEC of 181 µg/L. Four of the remaining five concentrations of cyanide in the effluent were above the MDL during the June 2007 and August 2007 samplings. Cyanide concentrations in the effluent collected during the receiving water sampling were reported as 9.0 µg/L (with a MDL of 2.0 µg/L and a reporting limit of 10.0 µg/L). Cyanide had been a constituent of concern in past years because it approached or even exceeded the prior MAEC of 50 µg/L in some years. In 1986 it was observed that the effluent cyanide concentrations often exceeded the influent concentrations by an order of magnitude. This trend continued during subsequent years of sampling and was the subject of a special investigation conducted by the AWWU. The conclusion of this investigation was that the measured increase in cyanide between the influent and effluent was the result of the treatment plant's incinerator. Cyanide formed in the incinerator during sludge incineration is returned to the plant during the stack scrubbing process (CH2M Hill, 1987; CH2M Hill in association with Loren Leman, P.E., 1988). Subsequently, cyanide decreased and this was believed to be due to the change in the scrubbing water source from recirculated primary effluent to well water. As discussed in Section 3.2.1, the high cyanide concentrations found in 2007 are believed to be the result of laboratory analysis methodology.

The most restrictive criteria of growth and propagation of fish, shellfish, other aquatic life, and wildlife was used for the hydrocarbon limits presented in Table 21. The MAECs for TAqH and total aromatic hydrocarbons as BETX were met again this year, with maximum levels in the effluent well below the state-specified limits. The parameter of TAqH was analyzed in effluent only during the receiving water quality sampling, and the TAqH concentration was 13.3 µg/L as compared to the MAEC of 2,715 µg/L. The maximum BETX value measured by the EPA 624 method of 47.5 µg/L was seen during the toxic pollutant and pesticide June 2007 sampling, and this value fell well below the MAEC of 1,810 µg/L.

The MAEC for total ammonia was met again this year, with effluent values exhibiting a maximum of 22.9 mg/L as compared to the MAEC of 1,774 mg/L. This MAEC is based on maximum criteria in saltwater of 9.8 mg/L based on a salinity of 20 psu, temperatures of 15 °C, and a pH of 8.0 units (EPA, 1989).

In addition to the MAECs based on the State and Federal water quality criteria, a number of other effluent limitations are specified in the NPDES permit. These daily, weekly, and monthly limitations include pH, TRC, BOD₅, TSS, and fecal coliform (Table 21). All of the parameters except fecal coliform were found to be within their permit limitations for 2007.

For fecal coliform, the permit limitation of a monthly geometric mean (of at least five samples) that shall not exceed 850 FC MPN/100 mL was not exceeded this year, with the maximum monthly geometric mean of 76 FC MPN/100mL. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in May 2007.

The permit limitations for monthly and weekly averages and daily maximum were met for BOD₅ and TSS. Amendments to the Clean Water Act (40 CFR; Final Rule, 8/9/94), require at least 30 % average monthly removal for both of these parameters. BOD₅ and TSS met this requirement on both an average monthly and annual basis with the lowest monthly removal of 30% for BOD and 72% for TSS. Removal of BOD₅ averaged 35 % for the 2007 calendar year. Average removal rate of BOD₅ has decreased slightly over the last few years; this is suspected to be due to a greater percentage of soluble BOD₅ that cannot be removed by primary treatment processes. The monthly removal for TSS ranged from 72 to 77 % with an annual average of 75 %, about the same as reported for the last eight years and well above the average monthly criteria of 30 %.

Concentrations of other toxic pollutants and pesticides detected in the influent and final effluent were generally lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants (Table 22). Toxic pollutants and pesticides also generally fell within the historical range of values seen in past years; levels of toxic pollutants and pesticides detected in the Anchorage effluent this year and over the previous five years are shown in Table 23. These data indicated some variability over time, but a generally similar pattern overall. Levels were low and often below reporting limits. As in the past, the types and concentrations of measured organic compounds varied between the two sampling periods. This is probably the result of different point sources discharging into the Municipality's wastewater system at various times. Also, in some instances, large differences in pollutant concentrations occurred between the influent and effluent. Inconsistencies can be explained by looking at sampling methodology and plant operation in the case of point-source contaminants. If spikes of contaminants are occurring in the influent, these might be hit or missed during sampling. On the other hand, an effluent sample could contain the contaminant because of mixing in the clarifiers. Differences in concentrations in influent and effluent samples could also be due to lower suspended solids in the effluent samples. This can be seen in Table 9 and Table 10, where greater variability usually occurs in the influent concentrations as compared to the effluent.

Historic discharge monitoring data (1986 - 2007) for other parameters of concern measured in the influent and effluent are presented in Table 25. Most parameters have remained fairly steady over time. Dissolved oxygen levels increased from 1986 with a peak in 1992, and then generally decreased over the last ten years, including 2007. The cause of the changes in DO levels is unknown, however, previous changes in sampling location could account for this. Other constituents of potential concern such as TSS have remained fairly steady in the effluent; influent TSS levels had increased during 1991 due to improved sampling methodology but have remained fairly steady since that time, although the average and maximum value have increased slightly this year. The BOD₅ effluent average during 2007 (148 mg/L) was similar to that seen in 2004, 2005, and 2006 and lower than that seen during the prior three years. However, BOD₅ levels in both the influent and effluent had generally shown a slight upward trend up until 2004 as a result of greater industrial contributors over the course of this long-term monitoring program.

Table 25. Historical Mean Monthly Discharge Monitoring Data (1986-Present) for Influent and Effluent Non-Metals.

Year	Temperature (°C)		pH ^a		TRC (mg/L)		DO (mg/L)		BOD ₅ (mg/L)		TSS (mg/L)		Fecal Coliform (FC/100 mL)		Ammonia (mg/L)	
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
1986-2001 Min	9	9	6.4	6.4	NA	0.6	NA	2.1	98	69	117	37	NA	5	NA	13.8
1986-2001 Max	17	18	8.2	8.5	NA	1.0	NA	8.6	296	156	307	86	NA	726	NA	29.3
2002 Avg	13.1	13.7	NA	NA	NA	0.4	NA	6.7	244	154	241	51	NA	179	NA	20.3
2002 Min	10.4	11.0	6.8	6.5	NA	0.3	NA	6.1	221	132	224	44	NA	32	NA	16.6
2002 Max	15.9	16.4	7.8	7.8	NA	0.5	NA	7.1	268	174	270	57	NA	462	NA	24.0
2003 Avg	13.6	14.0	NA	NA	NA	0.26	NA	4.9	252	161	235	48	NA	210	NA	21.8
2003 Min	11.4	11.2	6.9	6.6	NA	0.07	NA	3.8	228	155	215	44	NA	38	NA	20.3
2003 Max	16.1	17.1	7.8	8.1	NA	0.57	NA	6.3	269	170	252	52	NA	1141	NA	23.5
2004 Avg	12.9	13.6	NA	NA	NA	0.26	NA	3.9	226	148	229	49	NA	325	NA	20.9
2004 Min	10.6	11.2	6.7	6.6	NA	0.1	NA	2.1	205	133	204	45	NA	57	NA	17.2
2004 Max	16.2	17.2	8.0	8.1	NA	0.49	NA	5.2	259	168	280	51	NA	1213	NA	24.2
2005 Avg	12.7	13.2	NA	NA	NA	0.30	NA	4.6	205	148	235	54	NA	175	NA	20.0
2005 Min	10.7	11.1	7.4	7.2	NA	0.17	NA	3.1	194	131	216	45	NA	19	NA	18.5
2005 Max	15.6	16.1	7.9	7.5	NA	0.55	NA	6.2	284	174	273	58	NA	484	NA	22.0
2006 Avg	12.0	12.3	NA	NA	NA	0.34	NA	4.0	220	146	229	54	NA	44	NA	19.4
2006 Min	9.8	10.0	6.7	6.5	NA	0.18	NA	2.6	199	132	196	50	NA	4	NA	17.0
2006 Max	14.8	15.1	7.8	8.1	NA	0.56	NA	5.3	237	165	268	59	NA	229	NA	21.5
2007 Avg	11.8	11.9	NA	NA	NA	0.38	NA	3.7	229	148	231	57	NA	18	NA	19.3
2007 Min	9.4	9.9	6.6	6.5	NA	0.25	NA	1.5	180	124	195	48	NA	3	NA	17.2
2007 Max	14.6	15.4	8.0	7.9	NA	0.57	NA	6.1	279	174	284	66	NA	76	NA	22.9

^a Values represent monthly or yearly pH minimum and maximum

NA Not applicable

NT Not tested

The yearly average effluent fecal coliform bacteria concentration, reported at 18 MPN/100 mL for 2007, was considerably lower than the last four years. Elevated levels seen in 2004 were the highest yearly average seen on the program to date and were most likely the result of a program to optimize chlorine usage as described below. Lower fecal coliform values for 2006 and 2007 showing a downward trend are more in line with prior data, indicating that the disinfection efficacy at the WPCF has been improving.

As described in earlier reports, a project to improve the efficiency of the Asplund WPCF effluent disinfection system was implemented during 2001-2002. The chlorine injection process was improved by installation of rapid mixing equipment (the “Water Champ”, installed in November 2001) to mix chlorine gas directly with the effluent. Oxidation Reduction Potential (ORP) technology using a *Strantrol 890 Controller* was installed in December 2001 to control the chlorine dosage rate by adjusting it in response to both flow and oxidation reduction potential of the wastewater. Prior to this improvement, it was never possible to determine an exact correlation between TRC and coliform kill. Dosage control by the ORP has resulted in adequate coliform kills with far lower residuals and has substantially reduced the annual chlorine usage, but optimizing the disinfection process has been an on-going process.

The average TRC had dropped from 0.8 mg/L in 2001 to 0.4 mg/L in 2002, and TRC levels fell even lower in 2003 and 2004, with average TRC values of 0.26 mg/L for both of these years. The average TRC increased slightly in 2005 and 2006 with values of 0.30 and 0.34 mg/L, respectively. The average TRC in 2007 was slightly higher with an average concentration of 0.38 mg/L with a range similar to that seen in 2005 and 2006. The average fecal coliform monthly average rose from 39 FC MPN/100 mL in 2001 to a high of 325 FC MPN/100 mL in 2004, and in 2007 has dropped back even further to 18 FC MPN/100 mL. As noted above, there was the one exceedance in 2007 of stated permit limits for fecal coliform that were reported to EPA with the May 2007 DMR, when 10% of the samples exceeded the monthly permit limit.

Quarterly WET testing was conducted on 24-hr flow composite effluent samples during all four quarters of calendar year 2007. Echinoderm fertilization tests were performed during the first, second, and fourth quarters of 2007. Use of this test during the first, second, and fourth quarters was based on the screening test results from the fourth quarter of 2006 and the third quarter of 2007, which had determined the sea urchin to be the most sensitive species tested. Annual three-species re-screening for the most sensitive species in 2007 was performed during the third quarter, and the sea urchin was again found to be the most sensitive species. Although a toxic response was seen from the effluent during the 1st and 3rd quarter WET testing, all results were found to be acceptable and within the Permit specified limit of $TU_c < 143$ and required no additional testing.

In summary, effluent chemistry monitoring indicated that with the exception of fecal coliform, effluent concentrations of toxic pollutants and pesticides, metals and cyanide, and conventional parameters were much lower than their applicable permit limits or their MAECs. For fecal coliform, the criterion of not more than 10 % of the samples exceed 2600 FC MPN/100 mL was not met during one month of 2007. All toxic pollutants and pesticides concentrations including metals and cyanide were lower than or within the range of those detected at secondary treatment plants from across the nation.

5.1.2 Sludge Monitoring

The current permit requires sludge monitoring twice per year, once each during the dry and wet conditions in summer as part of the toxic pollutant/pretreatment monitoring. There are no Part 503 monitoring requirements included in the permit, but sludge monitoring is required because the Part 503 regulations are self-implementing as described in Section 2.1.5. Part 503 monitoring of sludge at Asplund WTCF has been included in this report (Table 13) and will also be reported separately to EPA as required by the regulations by 19 February 2008.

While limits for levels of toxic pollutants and pesticides in sludge are not part of the current permit, comparisons can be made for these data based on other treatment facilities' monitoring results and to the site specific allowable limits for metals that were determined for the facility. In all cases, sludge metals were found to be substantially lower than the site specific allowable limits (Table 13). Again, data indicate that concentrations of toxic pollutants and pesticides in Anchorage sludge are generally lower than "typical" concentrations seen at other treatment facilities (Table 26). For the last three years, arsenic concentrations in sludge were less than those typically seen, however in 2007 arsenic was slightly higher with an average of 5.0 µg/g compared to a typical concentration of 4.6 µg/g. Arsenic during the February and October monitoring were both higher than the typical concentration at 5.67 and 7.85 µg/g, respectively, although both of these analyses were performed by an outside laboratory due to construction activities at the WPCF. The average mercury concentration measured during the Part 503 sampling was 0.818 µg/g, below the typical concentration of 1.49 µg/g. Mercury concentrations measured during the two toxic pollutant sampling were also less than the typical concentrations. The other Part 503 metals tested (beryllium, cadmium, chromium, lead, and nickel) also fell below typical concentrations.

Other metals that were monitored but not a requirement of the Part 503 regulations were copper, selenium, and zinc. Copper and zinc concentrations were both below typical concentrations. The selenium values reported for the June and August 2007 samplings event were 2.24 and 2.46 µg/g, respectively, compared to the typical concentration of 1.11 µg/g and a 95th percentile concentration of 4.85 µg/g.

Table 27 provides an overview of historical sludge data for total recoverable metals. In general, year 2007 data indicated similar concentrations of arsenic, cadmium, chromium, lead, mercury, and nickel compared to historical data over the last few years. Beryllium was not-detect in 2007, however the laboratory reporting limits were above both the typical and the 95th percentile concentrations (Table 26).

5.2 WATER QUALITY MONITORING

5.2.1 Plume Dispersion Sampling


To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, the non-parametric Kruskal-Wallis Test (Zar, 1984) was employed which determined whether significant differences occurred within the sample group. If significant differences were observed, Dunn's test, a test that performs pairwise tests of significance ($\alpha = 0.05$), was employed (Dunn, 1964). The results of these tests for the June survey period as a function of water quality parameters are presented in  Table 26. Non-detect values were replaced with the detection limit value for statistical testing.

Table 26. Comparison Between Sludge Analysis Results for Anchorage and Typical and Worse Case Concentrations Used by EPA in Developing Median or Mean Environmental Profiles^a. All concentrations are in µg/g dry weight.

Pollutant	2007 Anchorage Values			Typical Concentration	95 th Percentile "Worse Case"
	June ^b	August ^b	2007 AVG ^c		
Aldrin/Dieldrin	ND (0.0053) / 0.0040 J, COL	ND (0.0058) / ND (0.0058)	---	0.07	0.81
Arsenic	3.69	3.93	5.0	4.6	20.77
Benzene	0.016 J	0.013 J	---	0.326	6.58
Benzo(a)anthracene	ND (13)	ND (110)	---	0.68	4.8
Benzo(a)pyrene	ND (13)	ND (110)	---	0.14	1.94
Beryllium	ND (1.66)	ND (1.37)	0.06	0.313	1.168
Bis(2-ethylhexyl)phthalate	15	33 J	---	94.28	459.25
Cadmium	ND (1.66)	ND (1.37)	1.56	8.15	88.13
Carbon Tetrachloride	ND (0.091)	ND (0.085)	---	0.048	8.006
Chlordane (α,γ)	ND (0.0053) / ND (0.0053)	ND (0.0058) / ND (0.0058)	---	3.2	12
Chloroform	0.015 J	ND (0.170)	---	0.049	1.177
Chromium	13.3	13.7	14.5	230.1	1499.7
Copper	181	191	---	409.6	1427
Cyanide	1.70/1.60	2.65	---	476.2	2686.6
DDT/DDE/DDD	ND(0.0053)/ND(0.0053)/ND(0.0053)	ND (0.058)/ND (0.058)/ ND (0.058)	---	0.28	0.93
3,3-Dichlorobenzidine	ND (25)	ND (230)	---	1.64	2.29
Methylene chloride	ND (0.091)	ND (0.085)	---	1.6	19
Endrin	ND (0.0053)	ND (0.058)	---	0.14	0.17
Hexachlorobenzene	ND (13)	ND (110)	---	0.38	2.18
Hexachlorobutadiene	ND (13)	ND (110)	---	0.3	8
Lead	9.76	18.9	18.9	248.2	1070.8
gamma-BHC (Lindane)	0.0010 J, COL	ND (0.0058)	---	0.11	0.22
Malathion	ND (0.97)	ND (0.82)	---	0.045	0.63
Mercury	1.03	1.04	0.818	1.49	5.84
Nickel	10.0	11.0	11.0	44.7	662.7
PCBs	ND (0.10)	ND (0.11)	---	0.99	2.9
Pentachlorophenol	ND (61)	ND (560)	---	0.0865	30.434
Phenanthrene	ND (13)	ND (110)	---	3.71	20.69
Phenol	ND (13)	ND (110)	---	4.884	82.06
Selenium	2.24	2.46	---	1.11	4.848
Tetrachloroethene	0.280	1.2	---	0.181	13.707
Trichloroethene	0.0042 J	0.0081 J	---	0.46	17.85
2,4,6-Trichlorophenol	ND (13)	ND (110)	---	2.3	4.6
Vinyl Chloride	ND (0.091)	ND (0.085)	---	0.43	311.942
Zinc	420	532	---	677.6	4580

^a Source: EPA 1985c. *Summary of Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge: Methods and Results*. Office of Water Regulations and Standards, Appendix F.

^b Data from NPDES 2007 toxic pollutant and pesticide monitoring

^c Average from 2007 Part 503 sludge monitoring results

--- Not monitored in-plant for Part 503

COL More than 40% RPD between primary and confirmation results. The lower of the two results is reported.

J Estimated value (below MDL or MRL)

ND () Not detected (detection limit)

Table 27. Historical Discharge Monitoring Data (1986 - Present) for Metals in Sludge.

Year	Arsenic	Beryllium*	Cadmium	Chromium (Total)	Lead	Mercury	Nickel
1986-2001 Min	1.7	<0.02	0.7	3.38	24	<0.1	<8
1986-2001 Max	151	0.22	10.0	55	468	7.3	42
2002 Avg	2.7	0.13	2.6	20	32	1.2	16
2002 Min	2.1	0.08	2.0	16	22	0.8	10
2002 Max	3.3	0.21	3.6	25	50	3.2	22
2003 Avg	2.2	0.15	1.9	14	29	1.3	20
2003 Min	1.7	0.07	0.7	8	19	0.9	7
2003 Max	2.9	0.23	2.7	19	47	2.1	53
2004 Avg	3.0	0.14	2.0	16	25	1.3	14
2004 Min	2.5	0.11	1.3	11	20	0.7	9
2004 Max	3.8	0.18	3.0	21	30	2.1	17
2005 Avg	2.4	0.21	2.0	14	25	1.5	16
2005 Min	1.8	0.13	1.69	12	10	ND (<0.021)	11
2005 Max	2.7	0.37	3.0	19	33	3.1	20
2006 Avg	3.8	0.06	2	17	26	0.86	15
2006 Min	1.9	ND	1.23	13	18.2	0.390	11.9
2006 Max	5.94	0.15	3	25	39.3	1.70	19
2007 Avg	5.00	N/A	1.56	14.5	18.9	0.818	11.0
2007 Min	ND(<3.2)	ND(<0.307)	0.986	12.8	9.8	0.576	9.43
2007 Max	7.85	ND(<3.38)	2.37	15.8	25.1	1.04	13.4

* Beryllium testing began in 1993

Data from the receiving water survey showed statistically significant differences between outfall and control stations for both temperature and salinity for all depths. These differences were the result of the control stations being warmer and slightly less saline; however, even though significant differences were found, these differences were very small. In the past the control stations have often been found to be less saline as a result of increased river influence on the north side of Knik Arm. Turbidity was found to be significantly different between the outfall and control stations for only the surface depth. pH units were found to be significantly between the within ZID group and all other groups for the surface between within and far-field groups at mid-depth, and between the two ZID groups and control for the bottom depth. No significant differences were seen for dissolved oxygen, fecal coliform or TRC.

Although statistic differences were seen, all pH values fell within the AWQS of 6.5 - 8.5 and values did not vary more than 0.2 pH units that would be attributed to the outfall, as required by the AWQS. For color, concentrations were found to be elevated at all locations compared to most prior years, but concentrations at the outfall did not vary from natural conditions measured at the control site as required by the AWQS. High color readings that were seen in 2004, 2005, and 2007 are believed to be due to the naturally high suspended sediment levels in the samples from Knik Arm that were not completely removed from the samples prior to analysis.

Table 28. 2007 Station Group Differences at the 5 Percent Significance Level ($p \leq 0.05$) as determined by the Nonparametric Kruskal-Wallis (ANOVA) and Dunn's (ad hoc multiple comparison) Statistical Analysis Tests.

Water Quality Parameter	Water Column Depth		
	Surface	Middle	Bottom
<u>Conventional Analyses*</u>			
Temperature	<u>1 2 3</u> vs. 4	<u>1 2 3</u> vs. 4	<u>1 2 3</u> vs. 4
Salinity	<u>1 2 3</u> vs. 4	<u>1 2 3</u> vs. 4	<u>1 2 3</u> vs. 4
Dissolved Oxygen	NS	NS	NS
pH	1 vs. <u>2 3 4</u>	<u>1 2 4</u> vs. <u>2 4 3</u>	<u>1 2</u> vs. 4
Turbidity	<u>1 2 3</u> vs. <u>3 4</u>	NS	NS
Color Units	<u>1 2</u> vs. <u>1 3</u> vs. <u>3 4</u>	----	----
Fecal Coliform	NS	----	----
Total Residual Chlorine	NS	----	----
<u>Metal and Hydrocarbon Analyses**</u>			
Arsenic	<i>SIG</i> , NS ^{TR}	----	----
Cadmium	NS ^D , NS ^{TR}	----	----
Chromium	NS ^D , NS ^{TR}	----	----
Copper	NS ^D , NS ^{TR}	----	----
Mercury	<i>SIG</i> , NS ^{TR}	----	----
Nickel	NS ^D , NS ^{TR}	----	----
Lead	NS ^D , NS ^{TR}	----	----
Silver	NS ^D , NS ^{TR}	----	----
Zinc	NS ^D , NS ^{TR}	----	----
Cyanide	NS ^{TR}	----	----
Total Suspended Solids	NS ^{TR}	----	----
Total Aromatic Hydrocarbons (BETX)	NS ^{TR}	----	----
Total Aqueous Hydrocarbons (TAqH)	NS ^{TR}	----	----

* Tests were performed on four Station Groups (Group 1: Within-ZID Sites; Group 2: ZID Boundary Sites; Group 3: Nearfield Sites; and Group 4: Control Sites). Bolded Groups signify *SIG* result. Underlined Groups are not significantly different from each other (Dunn's Test result, $p > 0.05$).

** Tests performed on stations located between the outfall (Drogue F1 sites) and the control (Drogue C1 sites).

---- Not Applicable (surface samples only)

NS Not Significant K-W Test Result ($p > 0.05$)

SIG Significant K-W Test Result ($p \leq 0.05$)

^D Dissolved

^{TR} Total Recoverable

In addition to the standard water quality sampling, concentrations of total aromatic hydrocarbons as BETX and TAqH were measured at the surface at six stations (three at the flood tide control site and three at the flood tide outfall site, along the first drogue track). No statistically significant differences in BTEX or TAqH concentrations were detected between the control and outfall stations. There were no BTEX concentrations above MDLs seen at the Control Stations. One ZID Station, had a BTEX value slightly above the MDL however, it was well below, the State of Alaska water quality standard of 10 µg/L. One other ZID Station and the associated field duplicate had estimated BTEX values. TAqH concentrations were seen at all six stations but with a maximum of 3.10 µg/L, were significantly less than the AWQS of 15 µg/L. In addition, visual comparison of TPAH concentrations did not indicate that levels were elevated at the outfall, although this has sometimes been seen in the past. All TPAH levels were relatively low.

Total suspended solids, cyanide, and total recoverable and dissolved metals samples collected at the outfall and control sites were also subject to statistical testing. The only statistically significant differences that were noted were for dissolved arsenic and mercury. Arsenic was elevated at the outfall station F1-1 while mercury was elevated at the control station C1-3. Within the outfall stations, concentrations for most of the dissolved metals were highest at Station F1-1 (within ZID boundary), with lead being highest at Station C1-2 (Control), and mercury and silver being highest at the Control Station (C1-3). It is possible that the elevated levels at Station F1-1 could be due to the influence of the outfall discharge, although the TSS concentration was also high at Station F1-1. Except for cyanide and chromium, all of the total metal concentrations were found to be highest at either the within ZID site, Station F1-1 or the Control Station C1-3 which were the two stations with the highest TSS. Cyanide was found to be highest in a duplicate sample from Station C1-2 at the control site and chromium was found to be highest at the Nearfield Station (F1-3). Again, apparent differences between the outfall and control stations levels were not statistically significant for any of the total metals or for TSS.

A comparison of the water quality data listed in Table 15 with the marine receiving water quality for the State of Alaska (Table 21 and Table 29) indicates that none of the parameters listed in Table 15 exceeded the State's standards. As noted in Section 3.2.1, with the exception of four stations (F1-1, F1-2, F2-2, and F2-3), all of the TRC concentrations were below the PQL of 0.010 mg/L. It should be noted that the lowest achievable method detection limit for TRC analysis in seawater (0.010 mg/L) is higher than the State-specified limits of 0.002 mg/L for salmonid fish and equal to the 0.010 mg/L limit for other marine species. As previously noted, although the amperometric method that was used is the preferred method due to less interference, all TRC methods are subject to positive interferences in estuarine or marine waters. In past years, some of the highest TRC levels were seen at the control stations.

The State's receiving water quality standard for the "growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers" is 15 µg/L for TAqH and 10 µg/L for total aromatic hydrocarbons. As seen in Table 17, these standards were not exceeded during the receiving water sampling. For all control stations (C1-1, C1-2 and C1-3) BETX was not detected, with method detection limits well below the state standards. Two outfall stations (F1-1 and F1-2) had BTEX values well below the state standards while at the third outfall station (F1-3) BTEX was not detected. In addition, for "contact recreation", the AWQS for hydrocarbons is as follows: "Shall not cause a film, sheen, or discoloration on the

Table 29. State of Alaska Water Quality Standards for Receiving Water.

Parameter	Most Restrictive Marine Water Quality Standards								
Fecal Coliform	Based on a 5-tube decimal dilution test the fecal coliform median MPN shall not exceed 14 FC/100 mL (harvesting for consumption of raw shellfish); a geometric mean of 20 FC/100 mL (for aquaculture of products not normally cooked and seafood processing); and not more than ten percent (10%) of the samples shall exceed 40 FC/100 mL (aquaculture of products not normally cooked and seafood processing).								
Dissolved Oxygen	Dissolved oxygen concentrations in estuaries and tidal tributaries shall not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.								
pH	pH shall not be less than 6.5 or greater than 8.5, and shall not vary more than 0.2 pH unit from natural condition.								
Turbidity	Turbidity may not exceed the natural condition.								
Temperature	Temperature shall not cause the weekly average temperature to increase more than 1° C. The maximum rate of change shall not exceed 0.5° C per hour. Normal daily temperature cycles shall not be altered in amplitude or frequency.								
Salinity	<p>Maximum allowable variation above natural salinity:</p> <table> <tr> <th>Natural Salinity (‰)</th><th>Man-induced Salinity (‰)</th></tr> <tr> <td>0 to 3.5</td><td>1</td></tr> <tr> <td>3.5 to 13.5</td><td>2</td></tr> <tr> <td>13.5 to 35.0</td><td>4</td></tr> </table>	Natural Salinity (‰)	Man-induced Salinity (‰)	0 to 3.5	1	3.5 to 13.5	2	13.5 to 35.0	4
Natural Salinity (‰)	Man-induced Salinity (‰)								
0 to 3.5	1								
3.5 to 13.5	2								
13.5 to 35.0	4								
Sediment	No measurable increase in concentrations above natural conditions.								
Color	Color shall not exceed 15 color units or the natural conditions, whichever is greater.								
Petroleum Hydrocarbons, Oils and Grease	Total aqueous hydrocarbons (TAqH) in the water column shall not exceed 15 µg/L. Total aromatic hydrocarbons (TAH) in the water column shall not exceed 10 µg/L. Shall not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils.								
Total Residual Chlorine	Concentrations shall not exceed 2.0 µg/L for salmonid fish or 10.0 µg/L for other organisms.								
Toxic and Other Deleterious Substances	See Table 21.								

surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils." No film, sheen, or discoloration was observed during the receiving water sampling program in 2007.

All the dissolved metals tested in receiving water (Table 16) as part of this program met the AWQS as shown in Table 21, even at Station F1-1 within the ZID. These included: arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. Testing of antimony, beryllium, selenium, and thallium in receiving water is not required by the permit and was not performed. Previous years of monitoring showed exceedances of water quality criteria for total recoverable metals that were due to the specified test methods in conjunction with high amounts of suspended particulates in Cook Inlet. Since the adoption of the more-appropriate SSWQC for dissolved metals in May 1999, the receiving waters of Cook Inlet near the Asplund WPCF discharge have been in compliance with the AWQS.

All cyanide samples collected during the receiving water sampling were above the State-specified criteria of 1 µg/L for marine aquatic life. The highest cyanide concentration was seen at Station C1-2 (Control) with a reported value of 13.0 µg/L. Since no statistical differences were seen between the outfall and control locations and since the highest cyanide levels were seen at the control sites, these levels are not associated with the outfall. It is believed that the high concentrations in the receiving water are the result of seawater interference during analysis. The laboratory utilized SM4500E which is a direct colorimetric method that has been shown to be inaccurate for the analysis of cyanide in seawater that is believed to be due to the high ionic strength of seawater, a known interference (Dzombak 2005) rather than the more appropriate SM4500D/EPA Method 335.2 that has been used in the past. Discussions with the laboratory indicated that they did not adjust their procedures to account for the seawater salts in the sample. The cyanide concentration in the effluent, that was measured as part of the receiving water sampling, was reported at a concentration of 9.0 µg/L, well below the MAEC of 181 µg/L.

In summation, statistical analyses of the 2007 receiving water quality data indicated that water quality outside the ZID was not degraded with respect to control stations for any parameters. Differences that were noted in some parameters such as salinity, temperature, and pH were unlikely to be influenced by the Asplund WPCF outfall. Except for cyanide discussed above, all AWQS were met for the Asplund WPCF receiving water quality program. Although some parameters appeared to be elevated at the outfall stations as compared to control stations, statistically significant increases at the outfall stations were seen only for dissolved arsenic and mercury, and all dissolved metals concentrations, including arsenic and mercury, were well below the AWQS. No statistically significant differences were seen for total metals, TSS, BETX, or TAqH hydrocarbon concentrations between the outfall and control locations and all hydrocarbon concentrations were below AWQS.

5.2.2 Fecal Coliform Bacteria

The ADEC has indicated that one of their primary concerns is bacterial contamination of the shoreline by the Asplund discharge, indicated by fecal coliform bacteria concentrations. Because the Knik Arm's water uses have not been classified, regulations provide that the most restrictive standard must apply. State marine water quality standards for contact recreation require that the geometric mean fecal coliform concentration taken within a 30-day period not exceed 100 FC MPN/100 mL and that not more than one sample, or more than 10 % of the samples if there are more than 10, exceed 200 FC MPN/100 mL. Criteria for secondary recreation and for industrial

water supply require that the mean fecal coliform concentration not exceed 200 FC MPN/100 mL and that not more than 10 % of the samples exceed 400 FC MPN/100 mL. State marine water quality criteria for the harvesting for consumption of raw mollusks and other raw aquatic life require that, based on a 5-tube decimal dilution test, the median shall not exceed 14 FC MPN/100 mL, and that not more than 10 % of the samples shall exceed 43 FC MPN/100 mL. For seafood processing water supply for products not normally cooked, criteria are that the geometric mean may not exceed 20 FC MPN/100 mL, and not more than 10 % of the samples shall exceed 40 FC MPN/100 mL. For seafood processing water supply for products normally cooked, criteria are that the geometric mean may not exceed 200 FC MPN/100 mL, and not more than 10 % of the samples shall exceed 400 FC MPN/100 mL. For aquaculture water supply, criteria are that the geometric mean may not exceed 20 FC MPN/100 mL and not more than 10 % of the samples may exceed 40 FC MPN/100 mL.

Since the harvesting of shellfish and other raw aquatic life is not performed in these waters, and there is no aquaculture or seafood processing, it seems that the criteria for secondary recreation is most applicable; however, these criteria are not the most restrictive. Therefore, the most restrictive criteria used were that the median shall not exceed 14 FC MPN/100 mL (consumption of raw shellfish and other aquatic life), the geometric mean shall not exceed 20 FC MPN/100 mL (seafood processing and aquaculture for raw consumption), and not more than 10 % shall exceed 40 FC MPN/100 mL (seafood processing and aquaculture for raw consumption; Table 29).

Statistical tests indicated that fecal coliform concentrations were not significantly different between the within-ZID, ZID boundary, and the nearfield outfall station groups as compared to the control stations (refer to Table 28). Fecal coliform concentrations were very low again this year, and values ranged from <2 to 4 FC MPN/100 mL at the outfall stations (including the ZID stations) and a range of <2 to 2 FC MPN/100 mL at the control stations. The median at the control stations was 2 FC MPN/100 mL, as was the median at the all outfall stations (stations both within and outside the ZID) for both ebb and flood tides, well within the 14 FC MPN/100 mL criterion. The control site had a geometric mean of 2.0 FC MPN/100 mL, while that at the all the outfall stations (inside and outside the ZID) was 2.5 FC MPN/100 mL, both well below the criterion of 20 FC MPN/100 mL. No measurements (0 %) at the outfall stations either within or outside the ZID exceeded 40 FC MPN/100 mL, compared to the criteria of not more than 10 % of the measurements may exceed 40 FC MPN/100 mL. No samples collected at the control stations exceeded this criterion. The highest fecal coliform concentration (4 FC MPN/100 mL) was seen this year at an outfall station.

Relatively low fecal coliform bacterial concentrations were seen in all three creeks sampled as compared to historical data, although all creek concentrations were still higher than with either the receiving water or intertidal samples that were collected. The two replicate fecal coliform concentrations measured in Fish Creek were 26 and 11 FC MPN/100 mL. Replicate concentrations measured in Ship Creek were lower at 13 and 4 FC MPN/100 mL, while those at Chester Creek were 2 and 4 FC MPN/100 mL.

The range of fecal coliform concentrations for all intertidal samples collected during 2007 was quite low at <2 to 2 FC MPN/100 mL, with a median of 2 FC MPN/100 mL and a geometric mean of 2 FC MPN/100 mL. These values met the most restrictive water quality criterion of a median of 14 FC MPN/100 mL and a geometric mean of 20 FC MPN/100 mL. The highest coliform concentrations were seen at Stations IT-2, 1200 m east of the outfall and IT-3, 750 m east of the outfall. Due to the very low values encountered in 2007 throughout the study area, it

is clear that the outfall was not affecting the intertidal zone during this sampling event. The criterion of not more than 10 % of the samples exceeding 40 FC 100/mL was met, as none of the intertidal measurements exceeded this value. Although not seen in this year's data, in the past, the slightly elevated fecal concentrations seen intertidally were attributed to heavy waterfowl use of the area. Fecal coliform concentrations in the effluent samples collected in conjunction with the receiving water, intertidal sampling, and stream sampling were higher at 12 and 40 FC MPN/100 mL for the two replicates. These values were similar to many of the average monthly values reported, which ranged from 3 to 76 FC MPN/100 mL (Table 8).

In summary, fecal coliform concentrations in 2007 were found be very low in both the receiving water and intertidal areas. No statistically significant differences were seen between station groupings for the ZID, ZID-boundary, or nearfield stations as compared to the control location. All three area creeks were also found to be low in fecal coliform concentrations in 2007. Fecal coliform samples collected during the receiving water sampling program met all AWQS criteria, including all outfall stations both within and outside the ZID. All fecal coliform samples collected from intertidal areas also met all water quality criteria.

6.0 CONCLUSIONS

The following conclusions were based on results from this year of monitoring as compared to the current NPDES permit:

- The influent, effluent, and sludge monitoring has shown that, with the exception of only fecal coliform, the Asplund WPCF met the NPDES permit requirements and complied with State of Alaska water quality standards. MOA's self-monitoring of BOD₅, TRC, pH, and TSS showed compliance with all 2007 permit effluent limitations.
- For fecal coliform, the maximum geometric mean of 850 FC MPN/100 mL was never exceeded in 2007. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in May 2007.
- MOA's self-monitoring of pH and TSS showed compliance with regulatory and permit effluent limitations. TSS and BOD₅ were well within the daily, weekly, and monthly criteria for the entire reporting period. Average monthly removals for BOD₅ and TSS of greater than 30 % are required by the amendment to the Clean Water Act (40 CFR Part 125; Final Rule, 8/9/94). The removal rate for both TSS and BOD₅ met the 30 % minimum removal requirement for all months during 2007. Annual removals were 75 % for TSS and 35 % for BOD₅ which indicate excellent plant performance.
- Total aqueous hydrocarbon and total aromatic hydrocarbon concentrations in the effluent were below their respective MAECs, as was total ammonia.
- Cyanide and metals concentrations in the effluent never exceeded their MAECs during any of the 2007 sampling events.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were within the established range or lower than values from a national study of secondary treatment plants. All toxic pollutant sludge concentrations were within the established range or lower than values from a national study of secondary treatment plants, with all metals falling at or below typical concentrations and well below 95th percentile worst case values.
- Whole effluent toxicity testing conducted quarterly met the permit limitations for chronic toxicity for all species and for sampling events in 2007.
- To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, statistical comparisons were employed. Conventional parameters such as salinity, temperature, and pH did show statistically significant differences between stations, but these were not ascribed to the outfall. Rather, these have historically been seen when comparing the Point Woronzof region to the slightly different water mass properties across Knik Arm at the control site due to river inputs. No significant differences were seen for dissolved oxygen, TSS, turbidity, fecal coliform, or color.

- Fecal coliform concentrations in offshore receiving water samples were found to be very low at all stations. State-specified criteria of a median of 14 FC MPN/100 mL, a geometric mean of 20 FC MPN/100 mL, and of not more than 10 % of the samples exceeding 40 FC MPN/100 mL were met at all receiving water locations. All fecal coliform samples collected from intertidal areas also met water quality criteria.
- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that dissolved metals were all below the State site-specific water quality standards. None of the dissolved metals exceeded the site-specific standards at the diffuser or at any other location. Significant differences between the outfall and control stations were seen only for dissolved arsenic and mercury. Arsenic was elevated at the outfall while mercury was elevated at the control site. These increased dissolved arsenic concentrations as compared to controls may be attributed to the outfall, but water quality standards were still met. Total recoverable metals were elevated compared to the dissolved, as expected, and this was attributed to high suspended sediment loads.
- Although all cyanide concentrations in the receiving waters (outfall and control locations) were above the receiving water quality criterion limit of 1.0 µg/L, no statistically significant differences were detected between concentrations at the control and outfall stations with the highest levels seen at the control locations. The elevated cyanide levels seen in 2007 were attributed to seawater matrix interference experienced by the laboratory and are not associated with the Asplund WPCF discharge.
- Supplemental receiving water samples also demonstrated that total aromatic hydrocarbons and total aqueous hydrocarbons met the State's water quality standard at all locations. No statistically significant differences were detected between concentrations at the control and outfall stations for either total aromatic hydrocarbons or total aqueous hydrocarbons.
- Turbidity met the State water quality criteria at all stations. TRC concentrations were at or below 0.010 mg/L (10 µg/L) at all stations, except three that were located within or near the ZID, as compared to the AWQS of 2.0 µg/L for salmonid fish and 10 µg/L for other marine organisms. As the lowest level detection limit that is achievable for TRC in seawater is higher than the State's most restrictive standard, it cannot be determined if this standard was met. Color was found to meet State water quality criteria of not exceeding natural conditions for all samples and locations.

CONCLUSIONS

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements with few exceptions and is showing no significant impacts to the marine environment.

7.0 REFERENCES

- Alaska Department of Environmental Conservation, 1999. Alaska Administrative Code. Water Quality Standards, Chapter 70, (18 AAC 70).
- American Public Health Association, 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. Washington, D.C. Various pagings.
- Anchorage Water & Wastewater Utility, 2000. 2000 Monitoring Program Plan. Prepared by the Anchorage Water & Wastewater Utility, Treatment Division, Laboratory Services Section.
- CH2M Hill, in association with Ott Water Engineers, Inc., 1984. Application for Modification of Secondary Treatment Requirements, Section 301(h), Clean Water Act. Prepared for Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- CH2M Hill, in association with Ott Water Engineers, Inc., 1985. Amendment to Wastewater Facilities Plan for Anchorage, Alaska. Outfall Improvements. Prepared for Anchorage Water and Wastewater Utilities, Anchorage, Alaska.
- CH2M Hill, 1987. Industrial Waste Pre-treatment Program, Annual Report. Point Woronzof Wastewater Treatment Facility. Prepared for the Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- CH2M Hill, in association with Loren Leman, P.E., 1988. Industrial Waste Pretreatment Program, Annual Report. Point Woronzof Wastewater Treatment Facility. Prepared for the Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- CH2M Hill, 1988. In situ Measurement of Dilution of John M. Asplund Water Pollution Control Facility Effluent in the Cook Inlet at Point Woronzof, Anchorage, Alaska. Prepared for the Municipality of Anchorage.
- CH2M Hill, 1997. Air Operating Permit Application. Submitted to the Alaska Department of Environmental Conservation. Prepared for Anchorage Water and Wastewater Utility, Anchorage, Alaska. December 1997.
- CH2M Hill, 1998. NPDES Permit Application for NPDES Permit and 301(h) Variance from Secondary Treatment. John M. Asplund Water Pollution Control Facility. Prepared for the Anchorage Water and Wastewater Utility, Municipality of Anchorage, Alaska.
- Code of Federal Regulations, 1999. 40 CFR Parts 104; 125; 136; 401; and 503. Title 40. Protection of Environment, U.S. Government Printing Office, Washington, D.C.
- Dunn, Olive Jean, 1964. Multiple Comparisons Using Rank Sums. Technometrics, Vol. 6, No. 3:241.
- Dzombak, D.A., R.S. Ghosh, and G.M. Wong-Chong. 2005. Cyanide in Water and Soil – Chemistry, Risk, and Management. CRC Press, Taylor & Francis.

- EPA, 1976. Quality Criteria for Water. U.S. Environmental Protection Agency, Washington, D.C. U.S. Government Printing Office: 1977, 0-222-904.
- EPA, 1978. Microbiological Methods for Monitoring the Environment. U.S. Environmental Protection Agency, EPA 600/18-78-017.
- EPA, 1980. Ambient Water Quality Criteria listed under Section 304(a)(1) of the Clean Water Act, October 1980, EPA 440/5-90-015 through EPA 440/5-90-079, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C.
- EPA, 1982a. Fate of Priority Pollutants in Publicly Owned Treatment Works. Final Report, Volume 1, EPA 440/1-82/303, Effluent Guidelines Division, WH-552.
- EPA, 1982b. Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters. EPA 430/9-82-010.
- EPA, 1983. Methods for Chemical Analysis of Water and Wastes. U. S. Environmental Protection Agency, EPA 600/4-79/020, revised March 1983.
- EPA, 1985a. Final NPDES Permit No. AK-002255-1 and attached Response to Comments on the Tentative Decision Document and Draft Permit for the John M. Asplund Water Pollution Control Facility. Prepared by the EPA 301(h) Review Team, Region 10. September 1985.
- EPA, 1985b. Analysis of the Section 301(h), Secondary Treatment Variance Application for the John M. Asplund Water Pollution Control Facility. Prepared by the EPA 301(h) Review Team, Region 10. September, 1985.
- EPA, 1985c. Summary of Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge: Methods and Results. EPA 822/S-85-001. Office of Water Regulations and Standards, Wastewater Criteria Branch, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1986a. Test Methods for Evaluating Solid Waste. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. EPA SW 846.
- EPA, 1986b. Quality Criteria for Water, U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, D.C. EPA 440/5-86-001.
- EPA, 1988. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. EPA 600/4-87/028.
- EPA, 1989. Ambient Aquatic Life Water Quality Criteria for Ammonia (Saltwater). EPA 440/5-88-004.
- EPA, 1992. Interim Guidance on Interpretation and Implementation of Aquatic Life Criteria for Metals. Health and Ecological Criteria Division, Office of Science and Technology. U.S. Environmental Protection Agency, Washington, D.C.

- EPA, 1993. Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. October 1, 1993 Memorandum from Martha G. Prothro, Acting Assistant Administrator for Water to EPA Regions I-X.
- EPA, 1994a. U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. U. S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA 540/R-94/013.
- EPA, 1994b. U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. U. S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA 540/R-94/012.
- EPA, 1994c. Water Quality Standards Handbook: Second Edition. Office of Water (4305). EPA-823-B-94-005a. U.S. Environmental Protection Agency, Water Quality Standards Branch, Office of Science and Technology, Washington, D.C.
- EPA, 1995. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms. First Edition. U. S. Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, OH. EPA 600/R-95-136.
- EPA, 1999a. Method 1664, Revision A. n-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry. February 1999. EPA-821-R-98-002.
- EPA, 1999b. Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants. EPA 833-B-99-002.
- EPA, 2000. Final NPDES Permit No. AK-002255-1 and attached Response to Comments on the Tentative Decision Document and Draft Permit for the John M. Asplund Water Pollution Control Facility. Prepared by the EPA 301(h) Review Team, Region 10. June 2000.
- EPA, 2001. September 28, 2001; Letter to Michele Brown, Commissioner, ADEC, from Randall Smith, Director, Office of Water, Environmental Protection Agency.
- EPA, 2006. September 15, 2006; Letter to Lynn J. Tomich Kent, Director, Division of Water, ADEC, from Michael F. Gearheard, Director, Office of Water, Environmental Protection Agency.
- EPA and Jones & Stokes Associates, Inc., 1982. Draft Environmental Impact Statement. Municipality of Anchorage Sewage Facilities Plan, Anchorage, Alaska. November 1982.
- Long, E.R., D.D. Macdonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. *Environ. Management*. 19: 81-97.

- Kinnetic Laboratories, Inc., 1979. Supplemental Studies of Anchorage Wastewater Discharge off Point Woronzof in Upper Cook Inlet. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska, R-79-13.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, in association with R.W. Hoffman, Ph.D., 1987a. Point Woronzof Monitoring Program, Annual Report, October 1985-1986. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, in association with R. W. Hoffman, Ph.D., 1987b. Point Woronzof Monitoring Program, Annual Report, November 1986-October 1987. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1988. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1987-October 1988. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1989. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1988-October 1989. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1991. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1989-October 1990. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1992. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1990-October 1991. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1993. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1991-October 1992. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1994. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1992-October 1993. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1995. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1993-October 1994. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1996. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1994-October 1995. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1997. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1995-October 1996. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1998. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1996-October 1997. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 1999. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1997-October 1998. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc., 2000a. Point Woronzof Wastewater Treatment Facility, Monitoring Program Workplan, October 2000. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc., 2000b. Point Woronzof Wastewater Treatment Facility, Initial Investigation - Toxicity Reduction Evaluation (TRE) Workplan, October 2000. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 2000c. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, November 1998-October 1999. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc., with Technical Review by CH2M Hill, 2001. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, January – December 2000. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc. 2002. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, January – December 2001. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

Kinnetic Laboratories, Inc. 2003. Point Woronzof Wastewater Treatment Facility, Monitoring Program Annual Report, January – December 2002. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.

- Kinnetic Laboratories, Inc. 2004. Anchorage Water and Wastewater Utility, John M. Asplund Water Pollution Control Facility at Point Woronzof. Monitoring Program Annual Report, January – December 2003. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc. 2005. Anchorage Water and Wastewater Utility, John M. Asplund Water Pollution Control Facility at Point Woronzof. Monitoring Program Annual Report, January – December 2004. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc. 2006. Anchorage Water and Wastewater Utility, John M. Asplund Water Pollution Control Facility at Point Woronzof. Monitoring Program Annual Report, January – December 2005. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Kinnetic Laboratories, Inc. 2007. Anchorage Water and Wastewater Utility, John M. Asplund Water Pollution Control Facility at Point Woronzof. Monitoring Program Annual Report, January – December 2006. Prepared for the Municipality of Anchorage Water and Wastewater Utility, Anchorage, Alaska.
- Micronautics, Inc. 2007. Tide1: Rise and Fall/Tide2: Ebb and Flow, Micronautics, Inc. © 1986-2007. Rockport, ME. Tide Tables 2007, High and Low Water Predictions, West Coast of North and South America.
- NOAA/NOS, 1995. Tide Tables 1995, High and low water predictions, West Coast of North and South America. U.S. Department of Commerce.
- Ott Water Engineers, Inc., Quadra Engineering, Inc., and Black and Veatch Consulting Engineers, 1982. Wastewater Facilities Plan for Anchorage, Alaska. Prepared for Anchorage Water and Wastewater Utilities, Anchorage, Alaska.
- Sombardier, L. and P.P. Niiler, 1994. Global Surface Circulation Measured by Lagrangian Drifters. Sea Technology, October 1994. pp. 21-24.
- UNESCO and National Institute of Great Britain, 1973. International Oceanographic Tables, Volume 2 (82 pp.)
- Zar, J.H. 1984. Biostatistical Analysis. Second Addition. Prentice-Hall, Inc., Englewood Cliffs, NJ. 718 pp.